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A facilitation process for self-directed learning.

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A FACILITATION PROCESS
FOR SELF-DIRECTED LEARNING

A Dissertation Presented

By

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by

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PREFACE

I have been privileged to serve as a counselor for self-directed learners during the last two years. I have learned a great deal from the undergraduates who have come from many different departments, seeking sponsorship and guidance. These students were attempting to build competence and knowledge in individualized ways, often through experiential learning. I was impressed by the excitement they conveyed. When their projects were going well, many of them enjoyed the satisfaction resulting from active learning for the first time in their lives.

Their verbal and written reports were different from those written by students in conventional classrooms. They did not write as though they were taking essay exams. They did not converse as if they were trying to impress an authority. Yet it was clear to me that they were learning in valid and important ways. They faced unusual problems, such as how to put their goals into words, how to structure evidence of learning without the help of a syllabus, how to evaluate themselves. Yet they made progress, without the help of lecturers of textbooks. They grew more competent, not only as beginning teachers, counselors, and experimentors, but as people growing more attuned to themselves and others.

I began to wonder how I could better understand the learning that they accomplished, and what I could do as a facilitator to help make their experiences more meaningful. When I began to study these things, I did not expect to become as involved as I did in the rigors of learning theory and physiology. However, I am grateful that I could begin to educate myself about neurology, perception, cognition, and educational psychology in the process of conceptualizing my own picture of learning.

In order to build a context for the facilitation process, I have written six foundation-laying chapters. The first introduces the problem, the need for the study, and the methodology. The second looks at processes in the nervous system. The third explores sensation and perception. The fourth examines concept learning and cognitive structure. The fifth explores the growth of competence. The sixth analyzes the kinds of questions asked by students. All of these contribute premises which inform the learning process.

The seventh chapter outlines a "blueprinting" process for project design and relates other facilitation factors to the ongoing support for self-directed learning. The eighth chapter shows how modes of reporting can reflect modes of examination. The ninth concludes by highlighting a value system for counselors, relating

self-directed learning to the growth of the whole person.

The reason for such a lengthy underpinning of theoretical premises is that I think one must have an idea of what one is facilitating before one facilitates it. I wanted to know what learning was, and I could not find a theorist who gave me a satisfactory answer. By beginning to build a picture for myself, I have learned much about the orderly processes governing our response to the world, and how a counselor can act as an educator, given students who are willing to pursue their own questions. More than anything, I have reaffirmed my respect for shared exploration, and my admiration for the individual thinking mind.

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I would like to express my gratitude to the students who taught me so much about self-directed learning. It has been a pleasure to know them as individuals as well as pursuers of knowledge.

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and Gail Kaufman of the University Without Walls, who invited me to work with admissions, orientation, and advising. The UWW Program first directed my interest to self-directed learning.

I am deeply grateful to Suzanne Grelson and Jacqueline Leach Bacon for their invaluable friendship. Though far away, they continued to act as models, moral supporters, and confidantes throughout the ordeal of research and writing.

I special note of indebtedness to my family, for their patience and support, and especially to my brother and his medical books.

A Facilitation Process for Self-Directed Learning

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This thesis has attempted to clarify a facilitation process for self-directed learning. In order to do this, a new picture of the learning process has been constructed. This picture is based upon the identification of processes operating within the neurological, sensory, perceptual, and conceptual systems in living organisms.

Learning was defined as the increased ability to respond effectively to the environment, through the acquisition of knowledge and competence. More specifically, this involves the increased ability to examine the environment in more discriminating ways (to become more responsive) and to organize responses in more efficient ways (to become more competent and responsible).

In clarifying the growth of knowledge, three modes of questioning, examining and reporting were identified.

Question Type	Intransitive	Transitive	Subjunctive
Examination Mode	Data-gathering Select Differentiate Pattern	Analysis Connect Modify	Synthesis Reorganize Integrate Conclude Predict
Report Mode	Identify Describe Define Compare	Explain Relate Translate Evaluate	Draw conclusions Plan Hypothesize Apply/Test Create

By using this knowledge-based continuum, a facilitator can help the learner to (1) locate the starting point of a self-directed project; (2) discern relevant modes of examination and reporting; (3) assess for himself that learning has taken place, without relying upon objective tests.

Competence was seen as the combining of simpler acts into complex ones, hierarchically organized and goverened by coded instructions. A competence-based continuum identified increasing levels of skill-building: (1) receiving basic instruction; (2) beginning skill development; (3) intermediate skill development; (4) advanced skill development.

In order to facilitate self-directed learning, a counselor helps a student to (1) identify goals for himself; (2) plan activities which work toward those goals; (3) plan ways to evaluate progress; (4) take major responsibility for his own growth.

A "blueprinting" process was derived from premises about learning and from a series of informal experiments on goal-specification. Using this process, a facilitator helps the student to (1) select an area of interest; (2) clarify it through differentiating it into parts, or through differentiating it from other related areas; (3) organize the parts into meaningful patterns;

(4) translate the patterns into "engagers"--questions, issues, tasks, etc. (goals that imply a beginning point and a termination point); (5) synthesize an overall goal statement; (6) plan activities which relate to goals; (7) plan ways to evaluate progress.

A facilitation process also involves assisting the learner to (1) engage his interests and enthusiasm; (2) assess his competence at dealing with new data, new problems, new skills; (3) consciously use coded organizers--concepts or themes which organize the examination and communication process; (4) respond to non-specific catalysts--questions which stimulate effective reporting; (5) utilize feedback; (6) gain competence through practice.

In addition, a facilitation process should effectively encourage the taking of responsibility, the growth of responsiveness, and the attainment of higher levels of individual excellence.

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The aim of education is to foster experiences, both in activity and thought, [which will] enable men to become rulers of their own lives, genuinely creative in their world, being totally responsible for themselves and their fellow men. . . . When people are free to choose what activities they will pursue, they will then be in a position to take real responsibility for what they do.

--"To Learn Together," New University Conference Newsletter (Chapel House, Chicago; May 24, 1968), Vol. I, No. 1, P. 3, cited in Harold Taylor, Students Without Teachers: The Crisis in the University (New York: McGraw-Hill, 1968), p. 80.

CHAPTER I

THE PROBLEM

This document is the synthesis of a series of inquiries. It began with a pair of basic questions. The first was: how can we, as counselors and educators, develop a process for helping students to become more self-directed in the pursuit of learning? The second arose from a need to clarify the nature of the learning process itself: how can we conceptualize "learning" when it is accomplished by a student outside the classroom?

The first chapter establishes a rationale for this study, through examination of four conditions:

(1) The options for self-directed learning are increasing, especially in higher education.

(2) This movement represents a departure from tradition, an alternative to the prescriptive classroom modes of learning.

(3) Little is known about how to help the student become more proficient at self-directed learning.

(4) Little is known about the learning process itself, especially as it relates to non-classroom experiences.

The first two of these conditions establish the context of the problem. The third and fourth establish the need for the study. We will explore each in turn,

and then summarize the problem, the incidence of the problem, and the purpose of each subsequent chapter.

The options for self-directed learning are increasing, especially in higher education.

Paul R. Givens summarizes programs at thirty institutions which "in some measure permit the student to design his own undergraduate program of study."[1] The institutions range from large state universities such as Alabama, Connecticut, Iowa, Minnesota, and Oregon to new and old private colleges of varying size, such as Brown University, Cornell College, Harvard, Princeton, Wesleyan, Holy Cross, and Johnston College.

Givens describes the increasing use of the learning contract, and includes a definitive statement which Evergreen College presents to its students:

> For a substantial part of your career at Evergreen, you may work in contracted studies. Using this pattern, you as an individual or as a member of a small group sharing your interests can sign up with a faculty member or other staff member to earn credit by doing a specific project, carrying out a specific investigation, mastering a specific skill, or dealing with a specific body of subject matter. . . . We call this arrangement a 'contract' for learning, to emphasize that it is an agreement to do a piece of work and that it implies direct, mutual responsibility between you and the experienced person whom you have asked to help you.[2]

Programs vary in their forms of evaluation, degrees

of freedom for the student and control by the faculty. This variety may be a function of the newness of the movement. As Givens states:

> . . . the range of programs described is wide, and reflects the degree of innovation which characterizes the move toward student-initiated academic planning. . . . It is interesting to note that this is a modern movement; with the exception of the Princeton program which was introduced in 1961, nearly all of the programs have been initiated within the last couple of years.3

In addition to the new opportunities for undergraduates on the campus, we see an increased willingness for universities to "expand" by finding ways to serve more diverse groups outside the campus. The development of England's Open University is being watched and evaluated, while task forces are at work in California, Massachusetts, and New York studying ways to bring the resources of their state universities within the reach of outlying communities. The University Without Walls network is operating on a number of campuses, including the University of Massachusetts, where "the program includes people with diverse backgrounds, ages, and interests; persons who are doing creative work outside the University and who need certification to become more effective; people who have full time jobs or other responsibilities precluding attendance in regular classes."[4]

Clearly the increased implementation of the expanded campus concept is accelerating the movement toward self-directed learning.

This movement represents a departure from tradition, an alternative to the prescriptive classroom modes of learning.

By bringing older and more experienced people to the academic community (or vice versa), we are moving away from the tradition of admitting large groups of eighteen-year-olds and steering them through the well-known sequence of arts and sciences. People who have been at work in their communities tend to see education in terms of what they need to know. They are less willing to waste time and money on courses which do not meet their needs. Offering options for self-directed learning is one way to maximize their satisfaction, at the risk of producing fewer graduate scholars.

As K. Patricia Cross stated in a recent article:

> . . . our new educational purposes suggest that we begin with the student and help him move toward the development of his abilities. It does not suggest that we try to make him into a pale carbon copy of the academically elite leader of bygone days.[5]

The Director of the Inner College Experiment at the University of Connecticut points out an underlying difference between the self-directed approach and the faculty-centered tradition:

> Where one theory views education in terms of motivation and growth in autonomy through personal involvement and responsibility, the other sees education in terms of mastery of a subject through expert instruction. Where one theory stresses the goal of self-fulfillment through exploration, the other emphasizes the goal of fulfilling standards of excellence; where one plays up the excitement of discovery on one's own, the other values the efficiency of informed teaching; where one encourages the student to prepare for new roles in society, the other prepares him for established careers.[6]

We may conclude that the movement toward self-directed learning is not only a new experimental thrust, but also the expression of a new theoretical position about education. Since the movement is relatively new, we have not yet synthesized a theoretical foundation nor gathered a body of well-researched facts with which to evaluate the movement. Further clarification is needed with regard to the nature of self-directed learning, and the means by which students can become progressively more autonomous.

It seems logical that since a faculty-centered, classroom-oriented approach to education is so universally practiced, the opportunity for a student to design his own curriculum will be in most cases a novel experience. We might compare it to a pianist who has always played music from a printed sheet suddenly being asked to play by ear, or to write a new composition. Unless the student is extraordinarily adaptable, he will have to go

through a long, expensive, trial-and-error process.

If we assume that more and more students will be attracted to self-directed learning options, and that more universities will want to encourage this kind of self-reliance, then we must develop ways to understand this new movement and develop ways to efficiently prepare larger numbers of students for this new mode of thinking and acting.

Little is known about how to help the student become more proficient at self-directed learning.

We have yet to discover a book on learning theory which even contains the phrase "self-directed learning," let alone includes questions or theories pertaining to its developmental aspects. Even the latest program descriptions fail to clarify how necessary skills are built, how contracts are negotiated, and how evaluation is done. The description provided by New College in Florida is typical:

> Each term you are at New College you will join with a faculty member (called a sponsor) to design a program of activities for that term. The program that the two of you agree upon is called a contract.[7]

But what happens between the initial meeting of student and sponsor and the signing of the contract? Are some sponsors more efficient than others in moving their students toward self-directed success? What are

the elements of a good advising process? How can we identify students whom we can truly call "self-directed"? Can we locate principles in learning theory that apply to adult learners?

Experts in student services have examined ways to foster student development. Do their ideas have relevance for self-directed learning? In some cases, it would seem so. Arthur Chickering, for example, reports four conditions which seem to foster competence, autonomy, purpose, and integrity. These are:

(1) accessibility, accompanied by informality and warmth;

(2) authenticity, or a firm value system which can be articulated;

(3) knowledge of his own discipline as well as familiarity with aspects of student development;

(4) The ability to talk with and listen to students (". . . a helpful response has five necessary ingredients: listening, watching, feeling, inquiring, respecting.").[8]

Do these factors facilitate self-directed learning? Without an adequate and applicable theory of learning, we can make these connections only through intuition. Little is known about the learning process itself, especially as it relates to non-classroom experiences.

Benjamin Bloom lamented over the fragmentation and

inconclusiveness of psychological learning theory when he was compiling his Taxonomy of Educational Objectives. He was attempting to define and rank various cognitive skills--thinking skills--which could logically be related to self-directed learning (e.g. comprehending, applying, analyzing, synthesizing, etc.).

> Members of the taxonomy group spent considerable time in attempting to find a psychological theory which would provide a sound basis for the taxonomy. We reviewed theories of personality and learning but were unable to find a single view which in our opinion, accounted for the varieties of behaviors represented in the educational objectives we attempted to classify. We were reluctantly forced to agree with Hilgard that each theory of learning accounts for some phenomena very well but is less adequate in accounting for others. What is needed is a larger synthetic theory of learning than at the present time seems to be available.[9]

Arthur Chickering traces other patterns of unanswered questions which also have relevance for self-directed learning. Quoting Dressel and Mayhew from their study of critical thinking ability:

> Attempts to relate growth in critical thinking ability to course organization or to specific teachers suggested that both of these were highly important, although the research could not identify specific factors that seemed to operate.[10]

Chickering's research at Goddard leads him to suggest a hypothesis that "development of intellectual competence varies with the particular requirements and conditions set for students. If this hypothesis is

valid, further study should reveal explicit ways to develop skills heretofore left to chance or to hazy and global aspects of curriculum or college environment."[11] He goes on to state:

> Research has left untouched some of the most important aspects of intellectual competence that may be fostered in college. Development of the ability to identify problems and to define them in clear and workable terms, of the ability to synthesize and integrate information from diverse sources for a particular purpose, and of the ability to operate creatively within existing conditions and to establish and maintain conditions that enable continued creativity--all merit careful attention. And the ability to be orally articulate and to listen, while perhaps more simple and obvious, are no less important.[12]

Are the above skills related to the ability to self-direct? At the present time, we still do not know.

Learning must involve the ability to do abstract thinking. Yet, studies of abstract thinking yield only descriptions, not explanations or useful procedures for the facilitator. For example, Goldstein and Scheerer tested hospital patients whose frontal lobes had been injured. In these patients, the concrete learning ability was not impaired, but various behavioral modes which Goldstein connects to abstracting ability, apparently could not operate. Patients with brain damage (1) could not detach themselves from concrete experiences (e.g. they could not repeat a sentence like "The snow is black," since it contradicts concrete experience); (2) could not

assume a mental set; (3) could not verbalize spatial relationships; (4) could not shift a mental set from one aspect of a task to another; (5) could not keep two tasks in mind simultaneously; (6) could not synthesize parts into an integrated whole; (7) could not abstract out the common properties of various tests, and (8) could not plan ahead.[13]

This study suggests that the planning of a project is as much of a challenge to abstract thinking ability as carrying out the learning project. All of the aforementioned processes may be crucial to self-directed learning. Furthermore, Goldstein and Scheerer make the interesting suggestion that abstract thinking is a new evolutionary development which can be activated by conscious will.

> . . . abstraction is <u>not</u> merely a higher degree of concrete ability; <u>nor</u> is it a synthesis or compounding of a number of lower order functions. Rather they believe that abstract thinking is a recent evolutionary type of ideational activity which is qualitatively different from the phylogenetically older concrete ability. According to these writers, the paramount factor in abstract thinking is <u>conscious will</u>. In other words, the individual must consciously reflect, judge, and look ahead before his thinking can qualify as abstract.[14]

Turning to studies of problem-solving and creative thinking, we find three Gestalt psychologist concerned with the thought processes. One is Köhler, whose experiments with chimpanzee "insight" are well-known. Another is Max Wertheimer, who studied "productive"

thinking in children. He found that children who were able to solve his geometric problems by insight rather than the indiscriminate application of teacher-taught procedures seemed to be "grouping," "centering" and "reorganizing" the parts into a "dynamic whole."[15]

Another Gestalt theorist, Karl Duncker, also studied creative or productive thinking, which was defined as that which occurs when the subject must solve a problem without using habitual means. Thus Kohler's apes had to use tools and stack boxes to get their food, and Duncker's college students had to figure out how to treat tumorous patients. While self-directed learning involves discovering one's own goals, rather than finding solutions to carefully designed problems, three principles from the Gestalt frame of reference seem to suggest interesting directions for study.

> (1) Thinking takes the form of a perceptual reorganization of the problem in a series of hierarchically related solutions which tend to become increasingly more specific. Both Wertheimer's and Duncker's protocols revealed such stepwise transformations in the subjects' thought processes. . . .
> (2) Perceptual reorganization during thinking tends in the direction of 'centering' and 'focusing,' of 'filling gaps,' . . . .
> (3) The readiness with which the solution is found is related to the fixity of the perceptual field, motivational factors, and the subject's previous training.[16]

While there are useful suggestions from various theories and studies, there is no clear picture of learning.

Statement of the Problem

Bloom's Taxonomy of Educational Objectives (cognitive) clarified the goals of teachers in terms of specific skills--retaining knowledge, comprehending, applying, analyzing, synthesizing, and evaluating. But as he stated, his task force was unable to find a theory that explained what these skills consisted of, or how they were built.

Chickering emphasized that course organization and the behaviors of specific teachers have been found to affect critical thinking ability. But there are no data explaining how specific requests or exercises serve to increase intellectual competence. Furthermore, he stated that he could find no research about the following aspects of intellectual competence: (1) the ability to identify and describe problems; (2) the ability to synthesize information for a purpose; (3) the ability to operate creatively; (4) the ability to listen and articulate.

These men suggest that there are specific skills that are crucial to learning--specific processes at work, but they have not yet been clearly identified or explained.

As we saw in the last section, researchers of abstract thinking have not yet penetrated beneath the

level of surface observations. Goldstein and Scheerer's study again suggested that specific processes are involved in abstract thinking. Certain "modes" are unable to operate when the abstracting areas of the brain were damaged; for example, the ability to plan ahead, to synthesize parts into a whole, to abstract the common properties of things, to step back from concrete experience. If we can identify skills such as these, discover the connections between them and the ability to self-direct, then we should be able to logically deduce a facilitation process.

We must also ask whether there are factors involved in learning that are not processes or skills. For example, Goldstein and Scheerer suggest that conscious will is a factor in abstract thinking. To consciously "reflect, judge, and look ahead," a learner must be interested in what he is doing. To what extent is interest or commitment a facilitating factor for self-directed learning? Are there other factors?

How can these processes and factors be arranged within a meaningful context? Can we organize the "parts" into a "whole" conception of learning and of the growth of the total person? We are looking at the learner as one who is exploring a non-familiar environment, or a non-prescribed problem. Let us assume that a learner

is self-directed when he:

(1) specifies educational goals for himself;

(2) plans activities which work toward those goals;

(3) evaluates his own progress;

(4) assumes major responsibility for the attainment of his goals.

Does self-directed learning relate to a broader picture of human growth? If so, can we identify values which serve as guidelines for the facilitator?

The problem for this dissertation has several parts, each representing a separate inquiry contributing to the final synthesis. The first objective is to identify some basic processes connected with learning. The second is to discover related facilitation factors. The third is to suggest a facilitation process which is congruent with these premises. The fourth is to clarify a broader context, an overall conception of self-directed learning as it relates to human growth, and as it relates to a value system that encourages the development of the whole person.

Incidence of the Problem

How did this problem actually come to light? When I began directing a program for self-directed learners, I found that students brought in some very exciting ideas. They wanted to augment their classroom

work with field experiences. They wanted to test their competence as teachers, counselors, or researchers, but could find no one to legitimize their work, through granting credit, nor to assist them in turning their initial ideas into manageable, clearly organized projects. Often they wanted to create something--an educational film, a community education program, a curriculum unit, etc., but had problems specifying what they wanted to learn from their creative experience. As I conversed with them about their ideas, I asked myself:

(1) How can I help them translate their desires into manageable, measureable progress?

(2) What is my role as a counselor and creditor? What demands should I make as a representative of the University? What values should I convey as a counselor interested in student development?

(3) Are these planned activities the kinds of things that a university ought to credit? Do they represent valid learning experiences? If so, how can I explain why?

As I tried to help students clarify their goals and write clear descriptions of what their experiences were, two problems became apparent to me. The first was that the contracts tended to be vague. Students drafted goal statements that identified an area of

interest, but did not specify measureable starting and ending points; for example, "I want to gain experience as a counselor in a junior high school," or "I want to explore various ways of teaching reading." These kinds of statements did not give me enough information about how the student was going to build on past experience, how I could help direct an ongoing review process that would be useful, or how to demonstrate that new knowledge and competence were indeed gained.

The second problem was that the initial progress reports tended to take the form of narrative descriptions. Students reported what they saw and what they did, in time sequence, from one day or week to the next. I felt dissatisfied with this mode of reporting, but I had no workable definition of learning which would tell me how to state more productive expectations. Did reporting one's experiences indicate that learning had taken place? I felt that perhaps describing and defining one's activities constituted the first step in a meaningful learning experience. But what was the next step?

Intuitively, I asked students to augment their objective descriptions with subjective interpretations. I saw that their excitement increased when they began to ask "Why?" and when they began relating their activities to more abstract conceptualizations--values, roles,

causes, effects, personal experiences, larger themes. Counseling interns became more engaged, for example, when they began to relate their work to a theoretical conception of what a counselor's role should be, just as I had become more exhilarated by the same sort of inquiry. When one reading program worked better than another, students began to probe for causal explanations, and their excitement grew.

Perhaps there were two different types of learning going on--the first being "static"--seeing what happens, seeing what something consists of--the second being "dynamic"--seeing how one thing relates to another. Could it be that these two kinds of inquiry were fundamentally different? Could it be that they involved different sets of skills, or reflected different processes at work in the brain?

A third type of examination began to take shape in my thinking as I studied the final reports of students. The clearest and most provocative write-ups represented the systematic drawing of conclusions. Objective observations were combined with subjective relationships to form a new total picture. Thus the counseling intern described her activities in terms of listening to problems and giving non-judgmental support (her descriptions constituted objective data). Secondly,

she saw that this was an example of an integrated theoretical approach to counseling, namely Rogerian non-directiveness, and related its underlying assumptions to her work (she analyzed her work). Finally, she concluded that very little change had taken place with regard to her client's behavior. Therefore, another approach to counseling would have to be studied and tried (she synthesized a new picture which informed her future behavior).

When these three kinds of inquiry were represented in a student's work, I felt that the most significant learning had taken place. But I could find no theory to back me up. Furthermore, I had some familiar guidelines that I used as a counselor (e.g. elicit statements, listen, give feedback, generate alternatives, support reasonable decision-making, etc.), but had never related these procedures to the pursuit of knowledge- or competence-based learning.

Therefore, the problem that began to intrigue me had two sides to it. The first was to clarify a picture of the learning process in such a way that it clearly reflected the activities of adult learners working outside the classroom. The second was to clarify the steps in a facilitation process, connecting them to this picture of learning, and to a value system which took

into account the growth of the whole person.

Methodology

A wide variety of approaches has been used to study learning. Philosophers have used introspection and speculation. Psychologists have studied perception and intelligence through the use of various tests. Behaviorists have studied the reactions of cats and rats in Skinner boxes. Gestaltists have hailed the performance of apes, who learn "through insight" to make tools. Ethologists have studied birds and fishes, debating the importance of inborn vs. acquired behavior. Recently, neurologists have begun to study brainwaves, and computer experts have designed programs which "simulate" mental processes.

Since I wanted to clarify a useful theoretical picture of the learning process, I began by surveying the major theories, sampling from the kinds of approaches represented above. I found that there was no comprehensive theory of learning for either adults or children, the last attempt at such a feat having been made by Hull. Furthermore, the suggestions put forth by various Behaviorists, Gestaltists, Functionalists, and Humanists seemed to be contradictory and inconclusive.

I began to explore textbooks on educational psychology. These contained some interesting contentions,

but were based implicitly on a traditional picture of the classroom teacher as a presentor-of-information, an examiner who wants to elicit the "correct" answer from students. Even Bloom's Taxonomy seemed bound by its insistence on hierarchy and by its conception of learning as a prescriptive experience (the teacher prescribes the task and judges the end product).

I consulted texts on counseling theory and dynamic psychology, but they neither gave satisfactory definitions of learning nor addressed the problem of how a counselor can act as an educator rather than a therapist.

After months of reading, I felt that I had not penetrated to the heart of the matter. I became more and more confused by the contradictory suggestions and fragmented laboratory experiments.

It was then that I saw the significance of Arthur Koestler's book, The Act of Creation. It suggested that there were orderly processes operating not only in the brain, but in the lower level systems and cells as well. These processes operated in other living organisms also, and they seemed to have evolved because they enabled living things to survive and grow more efficiently. Koestler emphasized the complementary processes of Differentiation and integration, the importance of coding mechanisms, the part-to-whole hierarchical

organization of structure and function, and the various filtering systems that we use as humans to perceive and communicate.

I wondered whether Koestler's ideas could be grounded in empirical facts, and applied to my own experiences as a counselor for self-directed learners. I began to study physiology and cognitive psychology in a different light--attempting to discover what processes were operating and whether they suggested principles of learning. I was essentially looking for metaphors. Differentiation and integration were analogous to analysis and synthesis, for example. As I perceived patterns connected with information-processing, I tried to order them in such a way that they suggested a useful picture of the learning process.

I checked these patterns against my perceptions of what self-directed learners were reporting. The metaphors seemed to work, in that they enabled me to conceptualize steps that self-directed learners were taking, and the barriers that obstructed them. The facilitation process that I had been intuitively using became clearer, as the parts of the theoretical picture became more organized.

Thus, the methodology has involved the identification of patterns and processes at many different levels,

including the neurological, sensory, perceptual and conceptual levels, as well as the analysis of the questions and reports that self-directed learners have submitted. Chapters II through VI attempt to establish a set of premises about the learning process. These premises are meant to be criticized and refined. While it may be questionable to attempt to extract premises from different areas of inquiry and from personal experience, J. G. Miller has recently emphasized the ongoing need for "cross-level hypotheses" about living systems:

> Recognition of the need for propositions in the sciences of behavior is by no means new. John Stuart Mill urged that general propositions be sought, 'empirical laws' expressing concisely the commonalities in large classes of findings. Homans has criticized his own field of sociology for not formulating such general propositions. And Berelson and Steiner (1964) have recently compiled from the findings of many observations in the psychological and social sciences 1045 such propositions of moderate generality. They state many of the principles of organismic, group, organizational, and social processes known today. Unfortunately, they have not dealt with biological findings, or the levels of cell and organ.[17]

Miller emphasizes that a conceptual scheme is not a research design or a substitute for one. Yet, to the extent that it stimulates dialogue and leads to testworthy hypotheses, it is significant.

Chapter VII represents a shift from an inductive methodology to a deductive one. Whereas the first part

of the dissertation attempts to build an outline of learning processes and facilitation factors, the second half attempts to derive a congruent facilitation process, a means of analyzing the reports of self-directed learners, and a set of useful value considerations.

Purposes of Individual Chapters

Chapter II is concerned with neurological information-processing. It examines the reflex arc concept in particular, since it is the foundation of the Behaviorist approach to learning. It then looks at how stimuli are "coded" into impulses and explores how they might be organized into configurations. It examines the possibility of a testing, matching, and modifying process for learning new patterns. It identifies two facilitation factors based on neurological principles: that the organism must be both competent and aroused before input can be processed.

Chapter III is concerned with sensory-perceptual information-processing. It identifies three processes connected with gathering basic data about the environment: selecting, differentiating, and patterning. It emphasizes the importance of forming and using patterns as coded organizers which aid reporting as well as remembering.

Chapter IV focuses on conceptual learning. It shows how differentiation (discrimination) and patterning

(abstracting) operate on the conceptual level to increase effectiveness of response. It asserts that perceiving the dynamic relationships between things (analyzing) is a different mode of learning than perceiving the static nature of things (data-gathering). It augments the meaning of three facilitation factors, connecting "competence" with the naturalness of the input, connecting "engagement" with the functional relevance of the input, and connecting the "use of coded organizers" with the notion of cognitive structure.

Chapter V shifts the emphasis from knowledge to competence. It asks how new skills are learned and asserts that simple acts are combined into complex ones, organized hierarchically, and governed by coded instructions. It emphasizes the importance of feedback and practice, and introduces the idea that non-specific catalysts can activate complex patterns of activity.

Chapter VI introduces the synthesizing mode of examination. It attempts to show that this mode is indicated by the types of questions asked by entering freshmen, as are the data-gathering and analyzing modes. It also analyzes the goal-oriented questions and relates them to a knowledge-based continuum.

Chapter VII clarifies a facilitation process in light of the preceding chapters.

Chapter VIII asserts that there are modes of reporting self-directed learning that reflect the modes of examination. Examples of these are given, using excerpts from students' reports. An underlying assumption is that self-directed learning is facilitated by a directed dialogue which helps the student assess his progress.

Chapter IX examines conflicting views of human growth represented by theories of motivation. It introduces a set of value considerations which are congruent with self-directed learning and the growth of the whole person. Broad counseling procedures are related to the increase of responsiveness, responsibility, and excellence.

Footnotes to Chapter I

[1]P. R. Givens, "Student Designed Curricula," College and University Bulletin, Vol. 24, No. 15, "Washington D. C.: American Association of Higher Education, May 15, 1972), p. 3.

[2]The Evergreen College Bulletin 1971-72, cited in Givens, "Student Designed Curricula," p. 4.

[3]Givens, "Student Designed Curricula," p. 3.

[4]Admissions Brochure, University Without Walls, University of Massachusetts, Amherst, Fall, 1972.

[5]K. P. Cross, "The New Learners," Change Magazine, February, 1973, pp. 32-33.

[6]C. A. McLaughlin, "Director's Report on the Inner College Experiment (Fall 1969-Spring 1971)" cited in Givens, "Student Designed Curricula," p. 3.

[7]"The Educational Contract," New College, Sarasota, Florida, cited in Givens, "Student Designed Curricula," p. 4.

[8]A. Chickering, Education and Identity "San Francisco: Jossey-Bass, 1969), pp. 243-247.

[9]B. S. Bloom, ed., Taxonomy of Educational Objectives Handbook I: The Cognitive Domain (New York: David McKay, 1956), p. 17.

[10]P. L. Dressel and L. B. Mayhew, "And There Should Be More," in P. L. Dressel, ed., Evaluation in the Basic College at Michigan State University (New York: Harper, 1958), pp. 232-241, cited in Chickering, Education and Identity, p. 23.

[11]Ibid., p. 24.

[12]Ibid., p. 24.

[13]K. Goldstein and M. Scheerer, "Abstract and Concrete Behavior: An Experimental Study With Specific Tests," Psychological Monographs, 53, No. 239 (1941), cited in J. P. Chaplin and T. S. Krawiec, Systems and Theories of Psychology (2nd ed.; New York: Holt, Rinehart & Winston, 1968), pp. 378-379.

[14]Chaplin and Krawiec, Systems and Theories of Psychology, pp. 372-373.

[15]Max Wertheimer, Productive Thinking, ed. by Michael Wertheimer (enlarged edition; New York: Harper, 1959).

[16]Chaplin and Krawiec, Systems and Theories of Psychology, pp. 372-373.

[17]J. G. Miller, "Living Systems: Cross-Level Hypotheses," reprinted from Behavioral Science, Vol. 10, No. 3 (1965), pp. 380-381.

C H A P T E R II

THE REFLEX ARC: FACT OR FICTION?

Man, in his complex environment, reacts continuously to a bombardment of stimuli. He sees, hears, and feels the changes going on around him. What unconscious processes enable him to make sense out of these changes? What steps can he consciously take in order to reach higher levels of understanding? We know that he perceives, that he thinks, that he remembers, that he communicates, by virtue of his humanity. But what do these terms mean? How do light waves, sound waves, and mechanical pressures become transformed into meaningful information? How are stimuli organized and integrated within the human brain? How can we picture the learner, reacting to new environments and experiences rather than memorizing pre-structured material?

This chapter attempts to explore the processing of information at the most basic level, as it occurs within the nervous system. It also attempts to establish some definitions and reference points.

How have others tried to define "learning"? Though many attempts have been made, the most recent ones portray learning in terms of behavioral changes rather than internal transformations. For example, Hilgard,

a psychologist who has surveyed the major twentieth century learning theories, states:

> Learning is a process by which an activity originates or is changed through reacting to an encountered situation, provided that the characteristics of the change cannot be explained on the basis of native response tendencies, maturation, or temporary states of the organism (fatigue, drugs, etc.).[1]

Tinbergen, an expert on animal behavior, states:

> Learning is a central nervous process causing more or less lasting changes in the innate behavioral mechanisms under the influence of the outer world.[2]

Vander, Sherman, and Luciano, authors of an outstanding book on human physiology, simplify the definition even more:

> Learning is the increase in likelihood of a particular response to a stimulus as the consequence of experience.[3]

Humanists have used less clinical language. For example, Arthur Koestler simply says that:

> Learning appears then as the adaptation of the innate potential to lived experience.[4]

Carl Rogers comes closer to conceptualizing learning in a self-directed context, but his definition deals with descriptive phrases rather than analyses of organic processes:

> <u>It has a quality of personal involvement</u>--the whole person in both his feeling and cognitive aspects being <u>in</u> the learning event. <u>It is self-initiated</u>. Even when the impetus or stimulus comes from the outside, the sense of discovery, of reaching out, of grasping and

> comprehending, comes from within. It is pervasive. It makes a difference in the behavior, the attitudes, perhaps even the personality of the learner. It is evaluated by the learner. He knows whether it is meeting his need, whether it leads toward what he wants to know . . . . Its essence is meaning.[5]

Perhaps the most sensible definition comes from Webster's Dictionary. It makes the useful differentiation between knowledge and competence.

> Learn: (1) to get knowledge of (a subject) or skill in (an art, trade, etc.) by study, experience, instruction, etc.[6]

All of these definitions imply that changes in the external world somehow produce internal changes. Let us assume that living organisms have an innate drive to survive, and that they do so by adapting to their environments. They become more responsive to the relevant details that surround them, and more effective at protecting themselves and achieving their goals. Changes in the external world somehow modify inner knowledge and affect behavior patterns. The idea of increased responsiveness seems to relate to both evolutionary development and personal growth.

How can we clarify a basic definition of learning that relates to self-directed endeavors, and that also points to a fruitful direction of study?

Let us look at how changes in the environment are registered by living organisms. At the most basic

level, changes are "sensed." Sensory receptor cells in the eye, ear, and skin are activated by various types of energy (light, sound, pressure). Changes in the environment, when received by the senses, become "sensory information."

When the input is relayed into the brain, it becomes perceptual information. Images are formed that may or may not be precise replicas of the perceived object. When the image is named or symbolized, it becomes conceptual information. Processes operating along this continuum must be related to learning. But how can we identify them? We only know that stimuli--changes in the environment--can be organized into knowledge--stored facts, concepts, and propositions, and that knowledge can help us to adapt to the world around us.

When changing stimuli produce glandular or muscular responses, we say that behavior occurs. When behaviors become coordinated in order to achieve a goal, we can say that competence has developed. The more competent we are, the more effectively we can live in our society.

Two different systems in the body must therefore relate to learning. One is the sensory-perceptual (cognitive) network, and the other is the motor system.

As the dictionary implied, the former deals with knowledge, and the latter deals with competence.

We will assume, for the purposes of this thesis, that learning is the increased ability to respond effectively to the environment, through the acquisition of knowledge and competence.

Overview of Chapter II

The nervous system is the most basic system involved in learning. It is the coordinator of events along the continuum, from the peripheral sensation of stimuli to the activation of goal-oriented responses. Input is processed through a series of conversions. Stimuli are transformed into electrical and chemical changes within the nervous system. Therefore, we must examine this system first, in order to identify some useful premises.

Two major perspectives have historically been used to examine the neurological network. One is the "molecular" approach, which focuses on chemical changes within the nerve cells themselves. The other is the "morphological" approach, which focuses on the interactions between the cells. This chapter begins by looking at the implications of both approaches. We will see that the morphological approach has given rise to the notion of the reflex arc. This very important concept underlies an entire school of learning theory, and must therefore be carefully examined.

We will ask whether the reflex arc is a fact or a fantasy, and whether it is a useful concept.

We will examine the objections to both historical approaches, and suggest a third. Rather than emphasizing the connections between nerve cells, we will explore the ways in which neurological processing represents a "coding" of input. We will identify two processes that seem to be crucial to the coding of input. One involves the formation of discrete units, and the other involves the combining of those units into configurations.

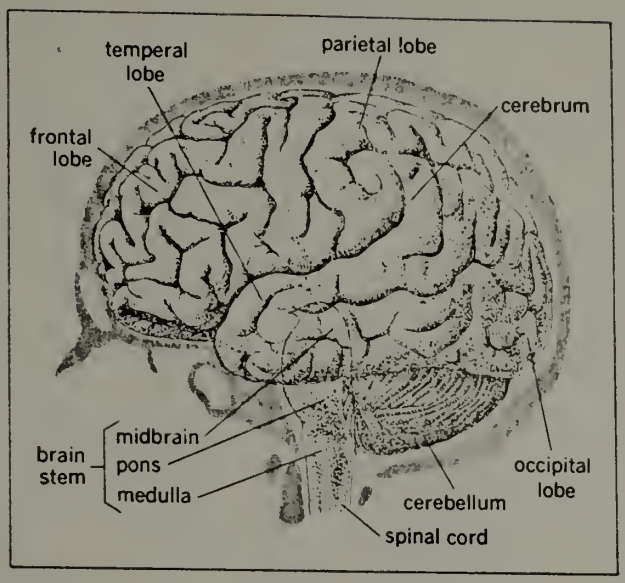
We will note two other facts about the nervous system, when it is viewed as a structurer of input rather than merely a conduction system. One is that the organism must be "aroused" before information can be processed. The second is that the organism must be competent to process certain types of input, in order for learning to occur.

We will discover two principles which clarify our initial assumptions about learning. One is that increased attunement to the environment involves learning to recognize new patterns, through a testing, matching, and modifying process. The second is that digital-to-analogue conversions are efficient coding arrangements, and this suggests a hierarchical means of information storage.

Molecular vs. Morphological Perspectives

First, what did the early theorists see when they looked at the nervous system? They saw a system of afferent and efferent nerve pathways, a brain, and a spinal cord. The afferent nerve bundles conducted impulses from the receptors in the skin and other senses to the higher integrating centers in the brain. The efferent nerves descended from the brain to the muscles and glands.

There was a complicated group of organs in between these pathways, which was seen as a mysterious connecting system. The brain stem--medulla, pons, and midbrain--contains a core of tissue called the reticular formation, which is an important integrating center for respiratory, cardiovascular, afferent and motor systems, and states of consciousness. The cerebellum, at the base of the brain, governs the unconscious coordination of muscle movements. The remaining large part of the brain is the cerebrum. Within its white matter lies the thalamus, a relay station and integrator of sensory information, and the hypothalamus, which initiates and coordinates reflexes. The cerebrum has a quarter-inch shell called the cortex, whose gray matter (14 billion neurons) is divided into areas or lobes (frontal, occipital, parietal, and temporal).



Label: Figure 1. Major Divisions of the Brain.

We will concentrate on the conducting pathways rather than on the functions of the brain organs, in order to try to understand how nerve impulses are sent and received.

Scientists noted that neurons (nerve cells) do not replicate themselves as do other cells in the body. Instead, they have fibers which branch out in all directions. Most of these outgrowths are specialized to receive impulses. They are called dendrites. Each neuron also has an axon--a fiber specialized to send impulses to the next cell. Only about ten per cent of the cells in

the nervous system are neurons, however. The remainder are glial cells, which originally were thought to sustain the neurons metabolically.

More recent research has shown that the glial cells actually guide the growth of neuron fibers. Furthermore, it was discovered that neurons produce more RNA (ribonucleic acid) than any other tissue in the body[7] (RNA is the chemical that establishes protein configuration; it is produced by DNA, the long molecule which contains the genetic blueprint). When stimulation ceases and RNA diminishes in the neuron, large concentrations of molecularly similar RNA begin to appear in the adjacent glia. It was noted that RNA molecules are complex and have unique configurations which can be altered over time.

A number of "molecular" theories have consequently emerged, suggesting that RNA is in fact the device for storing information. Experiments were performed in which RNA was extracted from rats, flatworms, and monkeys who had learned certain tasks. These extracts were fed or injected into naive subjects, and very often they showed superiority in performing the same tasks, as opposed to the performance of a control group.[8]

These experiments are reputed to be highly controversial. They do typify, however, the molecular approach to learning. Should we pursue this line of

inquiry? Clearly there are important discoveries to be made in the field of brain chemistry, but at this point, the approach does not appear to have any broader derivatives that we can apply to counseling.

On the other hand, "morphological" theories attempt to look at the relationship between the cells, rather than at the internal chemistry of the cells themselves. They contend that changes in the relationship between cells (i.e. modification of glial cells or new synaptic relationships) will eventually be confirmed as the important variables in learning.

At first glance, the morphological approach appears to be overly myopic for our purposes. But when we understand what the "connectionists" engendered, we see that we must examine this approach rather critically. The most famous example of the morphological theories is the concept of the reflex arc, which is used as the cornerstone of a broad and powerful interpretation of the learning process.

What does the term "reflex arc" actually mean? When early neurologists looked at the neuronal pathways, they pictured a series of connections, rather like telephone wires. They imagined that a stimulus was conveyed as an impulse along the pathways, from receptor (eye, ear, skin, etc.) to afferent nerves to connecting

fibers in the brain to efferent nerves to effectors (muscles or glands), thereby producing a response. This one-way street arrangement is called the reflex arc. Connections or associations between these pathways were assumed to be "strengthened" through practice and reinforcement.

An entire school of psychology was in effect founded upon this picture of how learning takes place. It has dominated the field since the beginning of this century. This Behaviorist or "stimulus-response" approach to learning continues to limit the thinking of modern theorists. It implies a picture of the learner as essentially a passive being, whose competence and knowledge are the result of "stamping in" by an outside stimulator. Consequently, the learner is not seen as an initiator, planner, controller, structurer of information, or creative being. Once the connections have been established between neurons, the individual supposedly cannot easily alter them, any more than he can choose not to jerk his foot when a mallet strikes his knee.

We can point to the learning theory implications of the morphological approach by presenting Arthur Koestler's schematic representation. This listing also presents a picture of the major opposing camp, the "cognitive" or Gestalt theories. It is useful to keep

an alternative in mind while examining the S-R approach. Koestler stresses that these two camps differ not on points of fact, but on their interpretations, selective emphasis, key concepts, and implied principles.[9]

S-R Theories	Cognitive Theories
Conditioning	Insight
Chained responses stamped in bit by bit	Patterned, flexible responses adapted to the total situation
Gradual learning by trial and error	Sudden learning and problem-solving through insight
Acquisition of habits and skills through reinforcement	Acquisition of knowledge ('cognitive structures') through latent learning
Emphasis on peripheral, sensory-motor activity	Emphasis on central cognitive processes
Emphasis on discrete stimuli, on parts and perceptual elements	Emphasis on relation--patterns, wholes, perceptual Gestalten
Motivation = reinforcement be need- or drive-reduction, or anticipation thereof	Motivation by exploratory drive, or its combination with other primary drives
Continuous linear gradient leading from rat to man	Hierarchic levels of organization

How did the morphological approach begin, and how did its psychological counterpart, the Behaviorist theories, develop?

For many years it was thought that nerves were interconnected fibers. In 1947, Sir Charles Sherrington

postulated that there were discontinuities in this wiring system. He named them "synapses." The junctions have since been exposed by the electron microscope. As a result, scientists have been obsessed by the question of how an impulse gets across this barrier, and how changes in the synaptic knobs might increase or decrease conductability. They looked usually at single transmissions, avoiding the question of how the brain codes and integrates the thousands of interrelated transmissions.

The presence of discontinuities in the neuronal pathways did not call the reflex arc into question for S-R theorists. Skinner himself stated that the reflex arc was "a fact."[10] Sherrington, the neurologist whose research gave rise to the Behaviorists' image of man as a bundle of S-R connections, cautioned that it was "a useful fiction."[11] Nevertheless, the Behaviorists went ahead and developed their theories, relying heavily on simple animal behavior and using language that was frustratingly rigid.

Watson launched the Behaviorist school of psychology in 1913, insisting that objective behavior should be studied and that feelings and ideas should not, since they were not "measureable." He asserted that behavior is made up of conditioned reflexes. Responses were learned through classical conditioning, first

demonstrated by Pavlov. Complex actions were merely a built-up series of connections between sensory receptors and motor effectors.

Guthrie (1886-1959) followed suit, emphasizing contiguity, or the fact that the stimulus and response occur together, which is supposedly the basic factor in learning. Modern investigators of retention have asserted that the problem of memorizing things is best conceptualized as preventing "interference," rather than building up the "strength" of connections. Thus learning becomes "resistance to forgetting," since, as Guthrie hypothesized, learned responses become fully associated with stimuli on the first trial, and remembering then involves preventing new and contradictory associations from being formed.[12] It must be pointed out that Guthrie's theories seem to have been formed as a result of watching cats trying to get out of puzzle boxes.

Thorndike (1874-1949) also formulated a number of laws based on animal problem-solving behavior. While neither Watson nor Guthrie had referred to reinforcement, Thorndike's "law of effect" asserted that the connections between a stimulus and a response were strengthened by a "satisfier." Thorndike believed that animals, including man, learned mainly through trial and error, without mediating ideas, aided by reinforcement.

The reinforcement principle was enthroned by Skinner (1904--) who divided learning into "respondent" and "operant" varieties. Respondent behavior is reflexive--made up of specific responses to specific stimuli, and operant behavior is "emitted" in response to complex external and internal stimuli. Both can be conditioned through reinforcement, as Skinner showed by teaching ping-pong to pigeons and rewarding rats for carrying marbles around. At the core of all these theories lies the concept of the reflex arc.

Is the reflex arc fact or fiction?

The following objections may be raised to the idea of an outside stimulator initiating a series of one-way connections between receptor cells and muscle cells: (1) simple connections between neuronal pathways are extremely hard to find; the reverberating loop arrangement is more typical than the one-way street layout; (2) divergent conduction is the rule; that is, neurons lead in hundreds of different directions; (3) higher centers in the brain exercise control over the reception of input, in effect "deciding" to some extent what shall constitute a stimulus; (4) large portions of the brain can be destroyed without disrupting behavior; (5) the brain is spontaneously active; it does not rely exclusively on an outside stimulator to send it into action. Let us clarify each of these criticisms.

D. O. Hebb, the noted psychologist, has pointed out that there was no knowledge of reverberating loops at the time that Watson and Thorndike were establishing S-R theory. We now know that the cortex is filled with neuronal connections that lead back into themselves, so that an impulse can be "held" without direct sensory excitation. (See Figure 2).[13]

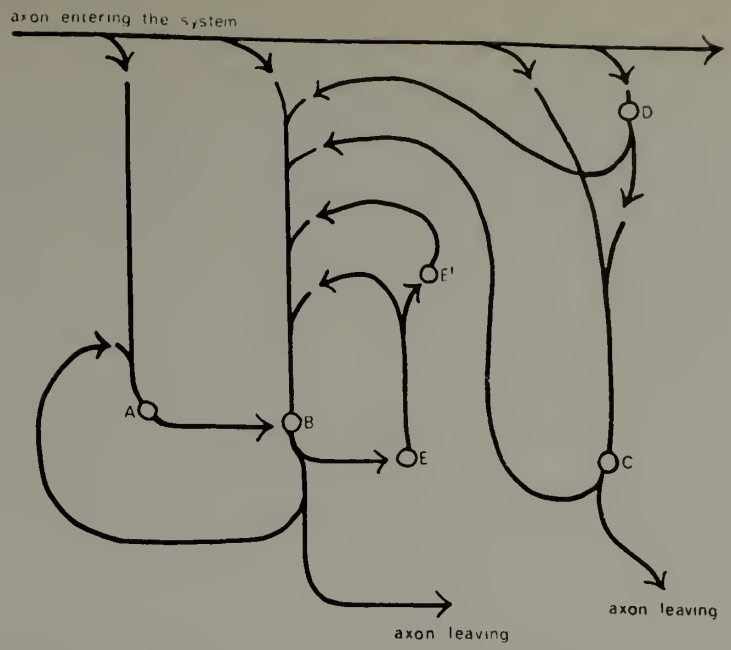


Figure 33. *Diagram of relations between neurons actually observed by Lorente de Nó. The entering axon excites the dendrites of four neurons,* A, B, C *and* D. *Of these* B *and* C *send impulses out of the system to excite other systems, but impulses from* A *and* D *are delivered only within the system itself.* A–B, B–E, *and* B–E–E′ *form closed circuits which can hold excitations and cause* B *to continue delivering impulses outside the system. (After F. A. Beach, et al. (Eds.),* The Neuropsychology of Lashley, *McGraw-Hill; cf. p. 467.)*

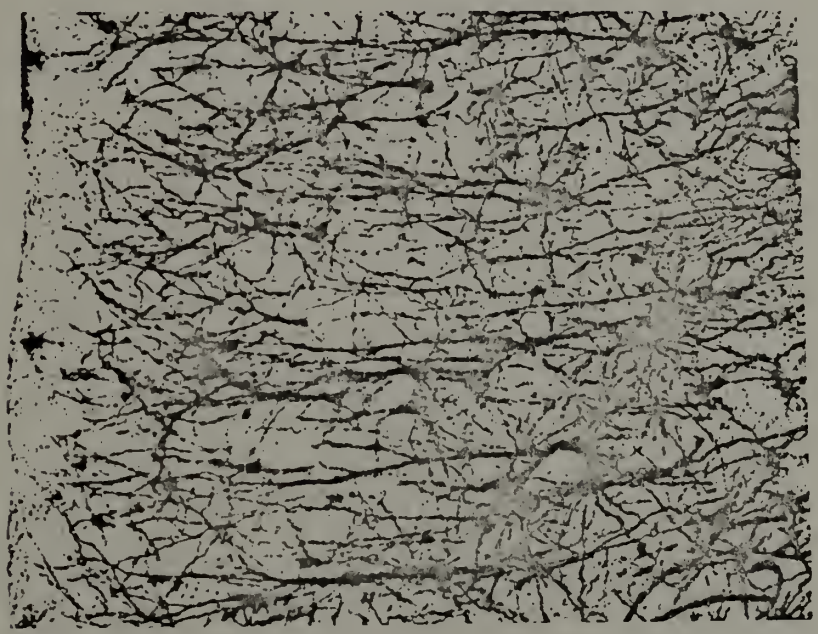


Figure 34. *Photomicrograph of a section of cat cortex, giving a better idea of the complexity of connections—but still only about one neuron in 60 is shown here, stained by the Golgi-Cox method which for some unknown reason is selective. If all were stained, no detail could be observed, only a solid mass of stained tissue. The outer layer of the cortex is at left. (From D. A. Sholl,* Organization of the Cerebral Cortex, *Methuen.)*

Label: Fig. 2. Relations Between Neurons.

Furthermore we know that excitations from sensory receptors are sent to the association cortex through "divergent conduction." The neurons lead in many directions, so that sometimes the impulses are relayed in a hundred different directions, or blocked, or held. Neurons and synapses are sometimes specialized to inhibit or facilitate transmission, apparently allowing for great selectivity.

It was also discovered that a great many receptors are in fact controlled by the higher centers in the brain, so that the organism in part "chooses" what shall become a stimulus and what shall not, and how it shall be integrated. The picture of the organism as a sort of machine waiting passively for stimuli to push its receptor buttons, responding automatically as the signals race down neuronal pathways, becomes inappropriate in light of discoveries about the enormous complexity of impulse conduction.

Conduction systems that resemble one-way streets are extremely hard to find. Why should the nervous system have evolved such a seemingly inefficient pattern of divergent conduction? Why should impulses be sent in hundreds of different directions? One answer may be that this allows information to be widely distributed throughout the brain. This would provide a kind of insurance against the loss of sensory-motor skills in

case part of the brain were destroyed. Responsive modes could then be maintained, despite injury. In fact, large portions of the brain can be destroyed with very little effect on complex behavior. If integration of skills were based on permanent associative connections, one would expect large holes in the areas of association to disrupt behavior. However, this does not happen as Lashley summarizes:

> Three lines of evidence indicate that certain coordinated activities, known to be dependent upon definite cortical areas, can be carried out by any part . . . of the whole area. Such a condition might arise from the presence of many duplicate reflex pathways through the areas and such an explanation will perhaps account for all of the reported cases of survival of functions after partial destruction of their special areas, but it is inadequate for the facts of sensory-motor equivalence. These facts establish the principle that once an association reaction has been established . . . the same reaction will be elicited by the excitation of sensory cells which were never stimulated in that way during the course of training. Similarly, motor acts (e.g. opening a latch box) once acquired, may be executed immediately with motor organs which were not associated with the act during training.[14]
>
> (italics mine)

The brain is capable of producing electrical waves continuously and spontaneously, without specific stimulation. These brainwaves are measured by the EEG (electroencephalagram), providing a sort of index of attentiveness. The rhythmic undulations of electrical activity

vary in their cycles-per-second rate, fastest during active thought, slowest during deep sleep. These waves can be produced without direct outside stimulation.

Is the reflex arc a useful fiction?

Even with the serious criticisms raised in the preceding section, do S-R theories have some usefulness? Do they inform us about how to increase the individual's responsiveness to the environment, or do they tell us (theoretically) how to control his response? We will have more to say about the value perspective engendered by this approach in the last chapter of this thesis.

The approach may be useful in terms of explaining very simple responses which truly are reflex--the dilation of an eye, the quick withdrawal of one's hand from a hot plate. It may explain some of the maxims that we take for granted--"practice makes perfect," rewards and punishments are important molders of behavior. Behavior modification has been extremely successful with patients who have a very specific problem (e.g. fear of snakes), with mental patients, with autistic children, and with performing animals. However, the image of a counselor systematically rewarding a student for becoming more observably self-directed is a contradiction in terms. A learner is not self-directed if his behaviors are planned and controlled by another authority. Thus the

reflex arc approach does not inform us as to how to work productively with independent, thinking adults.

A further problem with the usefulness of the construct is that it seems to limit the thinking of educators and theorists. Even Hebb, whose textbook on psychology was written in 1972, has not been able to break free of the connectionist influence of Watson and Guthrie, nor for that matter, to depart radically from the "tabula rasa" theories of British empiricists like Locke, Hume, and Berkeley.

For example, Hebb explains neuronal activity by suggesting that the "cell-assembly" is the basic unit of organization. He hypothesizes that common events repeatedly excite groups of neurons when we are infants. The core neurons tend to become connected with each other since they are active together. He speculates that when Axon X is close enough to fire Neuron Y, some kind of mysterious change occurs which makes X more capable of firing Y from that time on. He suggests that the reverse may also be true; when X delivers an impulse to Y and Y does not fire, subsequent impulses from X make Y less likely to fire. The core neurons would form a single system, perhaps through closing reverberatory circuits, and would develop inhibitors to suppress the firing of neighboring neurons.[15]

This approach, taken by itself, is as questionable as the nativist view that the mind is born with innate ideas about space, time, right, wrong, and God. It seems equally difficult to conceptualize such a complicated information-processing system as the human brain as organizing itself through random connections between fibers, inching toward each other within an undifferentiated neural net.

Should we adopt another perspective?

Obviously, if we wish to discover more applicable principles, we must begin to look at the sensory-motor system from another perspective. Neurologists like Lashley and Pribram have led us to ask: is it possible that behavior and ideation are not determined by the connections between neurons, but instead by the coding of patterns or ratios or relationships, and the processing of those coded patterns through widespread areas of the brain?

Experiments have shown that "within very wide limits, the absolute properties of the stimulus are relatively unimportant for behavior and that reactions are determined by ratios of excitation which are equally effective when applied to any group of receptor cells within the system."[16] Lashley summarizes the problem for future researchers:

> Here is the dilemma. Nerve impulses are transmitted over definite, restricted paths in the sensory and motor nerves and in the nervous system from cell to cell through definite intercellular connections. Yet all behavior seems to be determined by masses of excitation, by the form or relations or proportions of excitation within general fields of activity, without regard to particular nerve cells. It is the pattern and not the element that counts. What sort of nervous organization might be capable of responding to a pattern of excitation without limited, specialized paths of conduction?[17]
>
> (italics mine)

These speculations and questions point to a coding system of some kind. As humans, our most obvious and important coding system is language. Patterns become coded when we name them (e.g. "hexagon" is the coded name of a spatial pattern, "paranoia" is the coded name of a behavioral pattern). Relationships are also coded ("inch," "square root," "common law marriage"). We communicate through a process of encoding and decoding. Is it possible that the brain has its own language? Spoken language has units of meaning--letters, words, sentences, paragraphs, etc. What are the units of information in the brain? Language has rules of organization--grammar and syntax--and levels of abstraction. Are there hierarchies and rules operating within the brain?

Some work has already been done by scientists and computer technicians interested in systems. Some

of the cross-level hypotheses stated by J. G. Miller deal with coding, and he suggests that they may apply to coding processes in all living systems. For example:

> Hypothesis 3.3.4.2-1. As a system matures it uses increasingly more efficient codes, e.g. codes which require fewer binary digits or equivalent signals per unit signal. . . . (a) Simple symbols are used for the most frequent messages and more complex ones for the less frequent ones. (b) The symbols are selected to minimize confusion among them. (c) The symbols are chunked in long rather than short blocks.[18]

When Miller's 165 hypotheses appear in his forthcoming book, we can predict that a great deal of productive research will be done. Those of us who are interested in learning theory must be ready to interpret the results.

Furthermore, models are now being constructed which lend credence to the idea that a "cognitive structure" does indeed exist, and that it can literally be "attuned" by experience. The old telephone switchboard and file cabinet models of the brain are being replaced by the more complicated holograms and computer programs like EPAM, OCCAM, and Pandemonium, designed to "learn" various patterns and recognizable words. This is another reason why the "coding" approach to neurology is a potentially fruitful one.

Let us now shift our attention from the connections between neurons to the coding patterns produced by impulses.

The Coding Approach: Definitions and Premises

The stimuli that eventually become knowledge are transformed first into neurological information. How shall we define the word "information"? J. G. Miller says:

> Information is the negative of uncertainty. It is not accidental that the word 'form' appears in 'information,' since information is the amount of formal patterning or complexity in any system.[19]

J. Zeman States:

> The Latin word 'informare' from which is derived the word 'information,' signifies to put in form, to give a form or aspect, to form, to create, but also to represent, present, create an idea or emotion. It is possible to understand information in general as whatever is put in form or in order.[20]

Miller differentiates between "information" and "meaning."

> Meaning is the significance of information to a system which possesses it; it constitutes a change in that system's processes elicited by the information, often resulting from associations made to it on previous experience with it.[21]

Let us then define "information" as organized input. Input, in turn, consists of stimuli to which the organism responds. Stimuli are changes in the environment. The crucial question then is: how is input organized at the neurological level? How are internal processes organized so as to allow clarity of perception and effective adaptive response?

We will explore the concept of coding more thoroughly in Chapter IV as it relates to competence-

building. For now, we will define "code" as (1) a set of rules, and (2) a set of signals which have certain meanings. The assumption is that content and process are interrelated.

Six major premises will be presented in the concluding section.

(1) The organism must be competent to receive various types of input before it can process that input.

(2) All neurological information is coded into discrete units.

(3) Before information can be transmitted, the organism must be "aroused."

(4) Discrete impulses are combined and integrated.

(5) Digital-to-analogue conversions are efficient and can be hierarchically organized.

(6) The organism becomes more attuned to the environment by learning to recognize new patterns. This probably involves a testing, matching, and modifying process.

The organism must be competent.

On the most basic level, we can see an illustration of the principle that the organism must be competent to receive various types of information before it can be processed. Our sensory system is not competent, for example, to detect radioactivity, infrared light, or

television waves. There is no neurological context for this type of content.

Information is coded.

When light energy, sound energy, mechanical energy (touch), or chemical energy reaches our receptors, what happens to these stimuli? They become "information" by being coded into the language of "action potentials." All energy presented to the organism by the environment is converted to electrochemical energy by the receptors, given the fact that the organism is competent to receive it. Stimulation leads to the activation of nerve impulses.

> When the receptor is activated, the receptor membrane depolarizes, i.e. the inside of the cell becomes less negative, the extent of depolarization increasing with the increasing stimulus intensity and rate of change of stimulus application, i.e. how fast the stimulus is applied. . . . This graded, i.e. not all-or-none, response of the receptor is the generator potential. If the generator potential is large enough to depolarize the membrane of the afferent neuron to threshold, an action potential is initiated and propagates along the afferent neuron toward the central nervous system.[22]

This rather confusing language tries to summarize how the nerve impulse, this strange electrochemical disturbance, gets underway. When I first encountered explanations of this kind, I wondered such things as how a cell could become "less negative," how chemical and electrical energy could be interrelated inside the

body, and how nerve impulses could be represented so as to be instructive about coding.

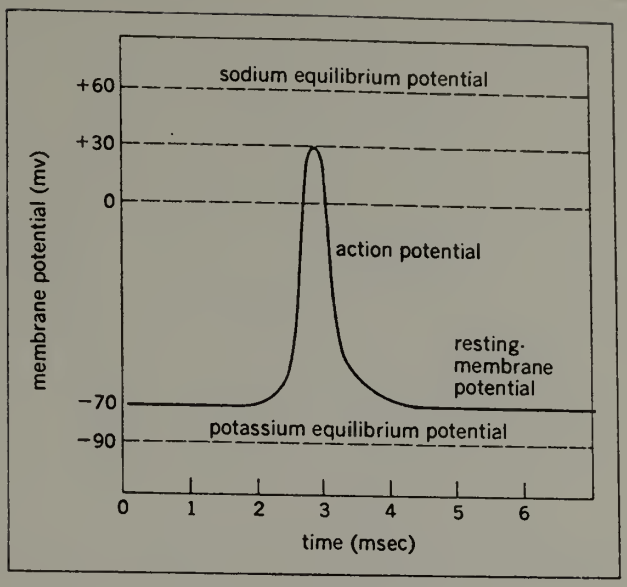
I first had to recall that all matter consists of atoms, and every atom contains an equal number of positively and negatively charged electrons. These unlike charges exert an electrical attraction (force) upon each other; this is how atoms maintain their stability. However, these charged particles can become separated. When this happens, the electrons or protons are called ions. The amount of force operating to pull them back together depends on the quantity of the charges and their distance from each other. The more ions are separated, the more voltage is produced. Voltage is the measure of the potential of separated electrical charges to do "work." Work, in physics, is defined as the product of force times distance.

Positive and negative particles can be separated by various chemical reactions. This is what happens inside of flashlight batteries. They can also be separated by diffusion. For example, sodium ions are positive and chloride ions are negative. Sodium chloride is a stable atom, otherwise known as salt. If we add a sodium solution to water, it will briefly produce a voltage difference, because chloride ions tend to move faster than sodium ions. Therefore, the

chloride will diffuse faster, and it has to separate from its sodium counterpart in the process. Until the sodium "catches up," there is a diffusion potential.

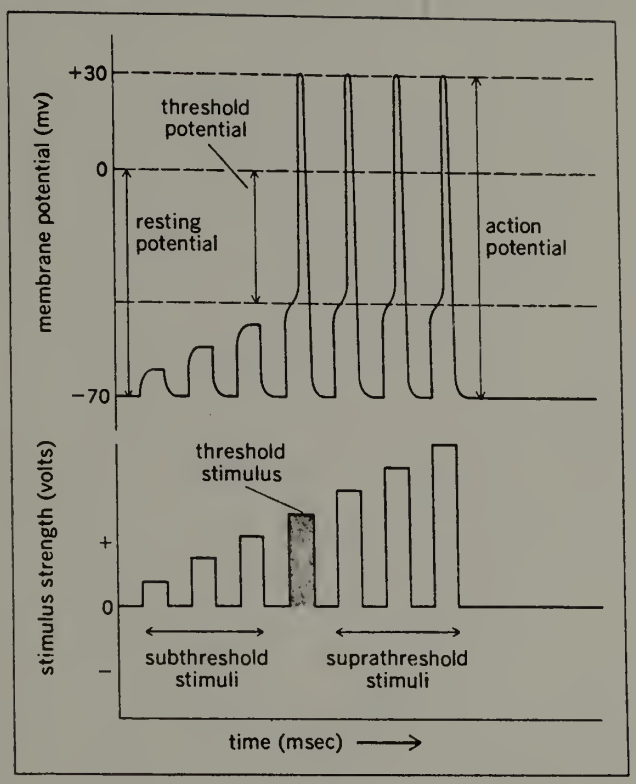
Due to the fact that living organisms evolved from cells in the ocean, our bodies contain a substantial amount of sodium chloride in the extracellular fluids. Our cells become negative when the membranes (cell walls) allow more negative ions (e.g. chloride or potassium) to come in. The cell membrane has a sort of transport system, like a pump, which moves ions in and out in order to maintain concentration levels. When this flux is taking place steadily, the cell is said to be "resting."

Nerve cells are extremely unique, however, in that they can produce a rapid change in the permeability of their membrane. When sufficiently stimulated, the membrane permeability to sodium ions suddenly undergoes a 600-fold increase. This means that the sodium ions move quickly inside the cell with all their positive charges. The cell fires like a shotgun, changing from negative to positive, and then returning to its resting phase in less than a millisecond. This can be diagrammed:[23]



Label: Figure 3. Action Potential

This action potential is transmitted from point to point along the surface of the cell membrane. All action potentials are virtually identical. Once the stimulus intensity reaches threshold (the level of excitability required to fire the impulse), it uses all of its energy, sometimes sending a number of action potentials on to the next cell. These are propagated without loss of amplitude (they don't become "smaller"). Once this occurs, the cell membrane needs a definite amount of time (refractory period) to "recharge."



Label: Figure 4. Generation of Action Potentials.

<u>The organism must be aroused</u>.

It is important to note that one impulse is usually not enough to fire the next neuron. Generator potentials (graded stimuli) must "sum their effects" to bring the next cell to threshold. Some neurons and synapses are specialized to inhibit firing, while others are built

to facilitate transmission. Nevertheless, for efficient conduction, a support system must usually be present. A higher level of wave activity may help transmission. This is the non-specific level of excitability measured as "beta waves," and it relates to the important mechanism of "arousal."

We know that the brain must be generally aroused before learning can occur. The slower "alpha" rhythm is associated with decreased levels of attention, and it must be changed to the faster "beta" rhythm, which signifies that the organism is perceiving, deciding, worrying, etc. This change seems to be catalyzed by the reticular formation in the brain stem. The reticular system activates whenever an "orienting response" occurs. This usually involves a surprising, novel, or interesting change in the environment. The orienting response consists of stopping what one is doing and looking around or listening. Physiological changes also take place, such as an increased flow of blood to the head, changes in the heart and respiratory rate, etc.[25]

When alpha waves change to beta waves, there is a difference in the overall firing patterns of neurons. When the brain is not reacting to a specific stimulus, the neurons somehow become synchronized, firing in step with each other. When the organism attends to something,

firing patterns become highly differentiated and asynchronomous. This non-specific excitability may facilitate synaptic transmission all over the brain. However, it may also signify that a great deal of "parallel" processing is going on--that the brain is simultaneously screening input through a variety of filters.

Apparently the arousal system also acts to increase selectivity in perception.

> Man is able to perceive a stimulus only when the nervous system is oriented and appropriately receptive toward it, and it is the neurons of the reticular activating system which arouse the brain and facilitate information reception by the appropriate neural structures. However, the sensitivity of this system is selective. A mother may awaken instantly at her baby's faintest whisper while she can sleep peacefully through the roar of a jet plane passing overhead. In fact, the arousal and the tuning in of one modality involves screening out others. Although it seems paradoxical that there should be a decreased overall sensitivity just when the nervous system is most aroused, this apparently allows greater attention toward specific sensory inputs.[26]

In other words, there are neurological reasons why a person must be paying attention in order to learn. Changes in the environment, if registered as relevant, produce an orienting response. This in turn activates a state of arousal in the brain. The resulting change from alpha waves to beta waves apparently increases

selectivity and facilitates neuronal transmission, and may also signify that a number of screening and processing systems are operating simultaneously.

Discrete impulses are combined and integrated.

We have summarized the mechanics of impulse transmission as a separate event. To try to conceptualize information-processing or increased responsiveness without looking for broader interrelationships, however, would be like trying to understand a rainstorm by looking at the individual droplets, to borrow Hebb's analogy. The sheer numbers involved are staggering. For example, as many as 1000 synapses may be possible between a single pair of neurons, and there are some 10 billion neurons in the system. The firings must be integrated and coordinated in some way.

We have seen that firings are coded into frequencies. A strong stimulation fires the cell more rapidly. Furthermore, different "messages" can use the same channels, if they are coded differently. One message may consist of regularly spaced bursts, another of irregular firings. We know that in temperature sensation, warmth produces a slower, more regular firing than cold does.

Coding depends not only on the frequency and regularity of firings, but also on the combination of neurons that are conducting. On a simple level, we

know that a sour taste on the tongue fires a different set of neurons than a salt or bitter taste.

Every time a neuron fires, its pattern of transmission represents the integrated input of all the synapses affecting it. When a number of neurons are firing simultaneously, another level of integration takes place. Aggregates of nerve firings become decremented into slower moving, localized potentials. These wave fronts then become indistinguishable from spontaneously generated local graded activity.[27] Thus the discrete impulses are combined at the synaptic level and integrated into wavefronts.

Analogue-to-digital conversions are highly efficient.

Neuron firings are coded into aggregates and patterns of action potentials. These localized wavefronts produced at the synaptic junctions may represent the conversion of digital, highly differentiated input into more efficiently processed analogue codes. Karl H. Pribram has suggested, based on a formidable array of research, that:

> the slow potentials produce patterns which serve a function in addition to a role of impulse transmission: the view taken here is that the slow potential pattern 'computes' both the spatial neighborhood interactions among neural elements and, to some extent, the temporal interactions over a range of sites by a continuous (analogue) rather than a discrete all-or-none (digital) mechanism.[28]

Condensing information into more concise configurations is analogous to grouping various objects or events under more abstract conceptual categories. Man has invented hierarchical symbol systems because they increase his efficiency at communicating, understanding, and responding to the environment. An analogue is a more compressed representation or process. "If you multiply by writing the numbers on paper, you are using a digital procedure. If you multiply by using a slide rule, you are using an analogue procedure."[29] We can clarify the usefulness of digital-to-analogue conversions by looking at Pribram's analogy of how computer programmers devised an octal coding system to run their machines.

> The general purpose computer. . . . can be manipulated only in the language it understands, a spatial or temporal sequence of ons or offs, of yeses or nos, of ups or downs, of a set of switches which the instrument presents. If there are twelve such switches we must remember how to set each for each operation we want the computer to perform. Communication therefore becomes a series of
>
> D U D D D D U D D U U U
> D D U D U D D D U D U U
> D U D U U U D U D D U D
>
> The task confronting the operator of the computer is therefore a formidable one of remembering long lists of ups and downs, strings of 'binary' numbers:
>
> 0 1 1 0 0 0 1 0 0 0 0 0
> 0 0 1 0 1 0 0 0 1 0 1 1
> 0 1 0 1 1 1 0 1 0 0 1 0

> Programmers were quick to get around this confusing way of managing their instrument: they divided the twelve switches into sets of three and labelled the up position with an integer increasing geometrically from right to left. Thus in each triad the position indicates 4 - 2 - 1, When two or three switches are up simultaneously, the sum of the integers is represented. Thus:
>
> 0 means D D D
> 1 means D D U
> 2 means D U D
> 3 means D U U
> 4 means U D D
> 5 means U D U
> 6 means U U D
> 7 means U U U
>
> and any sequence of twelve ups and downs can be described and remembered by four numerals, e.g. the sequences presented earlier become 3047; 1213; 2722.[30]

The economy of such a hierarchical organizing system is immediately apparent. Furthermore, the up-down arrangement reminds us of the rising and falling of the nerve impulse, as well as the on-off functioning of retinal cells responding to varying light intensities.[31] When we imagine a wavefront sweeping over perhaps 100,000 neurons per second, we can see the necessity for some kind of organization to be imposed. Pribram hypothesizes that these localized and temporary wavefronts represent configurations or ratios that higher information-processing centers can more readily identify.

Recognizing new patterns involves testing and matching.

Assuming that discrete firings are indeed re-coded

at the synaptic networks into compressed analogue patterns, are there structures that "read" these messages? It seems obvious that incoming patterns are "tested" for purposes of recognition.

We know that certain cells in the eye are more sensitive (more easily activated) by some shapes than by others. For example, some are built to recognize circular shapes. Others are more easily activated by elongated shapes--lines, edges, corners. Others react specifically to color, contour, and direction. These kinds of features are biologically and functionally relevant to humans. Different shapes are relevant to frogs, for example, and the frog's eye has adapted to receive them, as we shall see. Innate receptors, which are already attuned to features that reappear in the organism's environment from century to century, are wired in at birth, due to the mechanics of evolution.

As humans, we become accustomed to familiar things. We learn their names. We attach symbols to invariant patterns--"a triangle," "a book," "a French poodle." But what happens when we perceive a stimulus which is new to us? To even register it as "unknown" or "unclear" we must have tested it--matched it against an internal identification system. Without a specific name for it, we may match it against various categories of similarity

or difference. The discoverer of the coded symbols on Egyptian obelisks must have wondered how to label them. Writing? Decoration? Graffiti? The word "hieroglyphics" had not yet been invented.

A computer program called OCCAM was designed by Spinelli.[32] It can "learn" to recognize a pattern or wave form after it has been exposed to it on several occasions. It is based on Gerhard Werner's research into columnar structures in the brain.[33] These columns can be combined "into more complex structures by directionally sensitive units which serve as pointers connecting the activities of the columns."[34] In the same way, OCCAM's list structures can be tuned to respond when certain features of the wave form are repeated.

The columns can be said to "test" input and if it meets the right conditions (i.e. if it is recognized by the operation of interneurons which form the rungs of the column), then it exits to the next relay station, which in turn may relate the signal to other coding systems or engineer a response. The orienting response, which triggers the important arousal system, can then be said to activate whenever a "mismatch" occurs; whenever some incongruity, novelty, or conflict is perceived, it signifies perhaps that incoming patterns do not have a counterpart already represented in the self-adapting neuronal structures.

Incongruity, novelty, and conflict are examples of changes in the environment. The organism must adapt by activating operations which will handle the provoking stimulus--acting to identify it, understand it, or resolve the incongruity. Spinelli and Werner have hypothesized that cells may become organized into "columns" which replicate a unit of representation of the input. Through repetition, basic feature detectors may learn to become more "competent"--more discriminating--when combined with or supplemented by a feature selection system which can be tuned by experience.

Do we have any evidence that input is replicated, tested or matched? We know that patterned changes can be set up in the cortex as a result of stimulus repetition. Waves generated within the brain can repeat sequences presented regularly from the environment, and can become stabilized enough to organize the activity of other neural aggregates, acting in the same way as other substantially autonomous pacemakers in the body.[35]

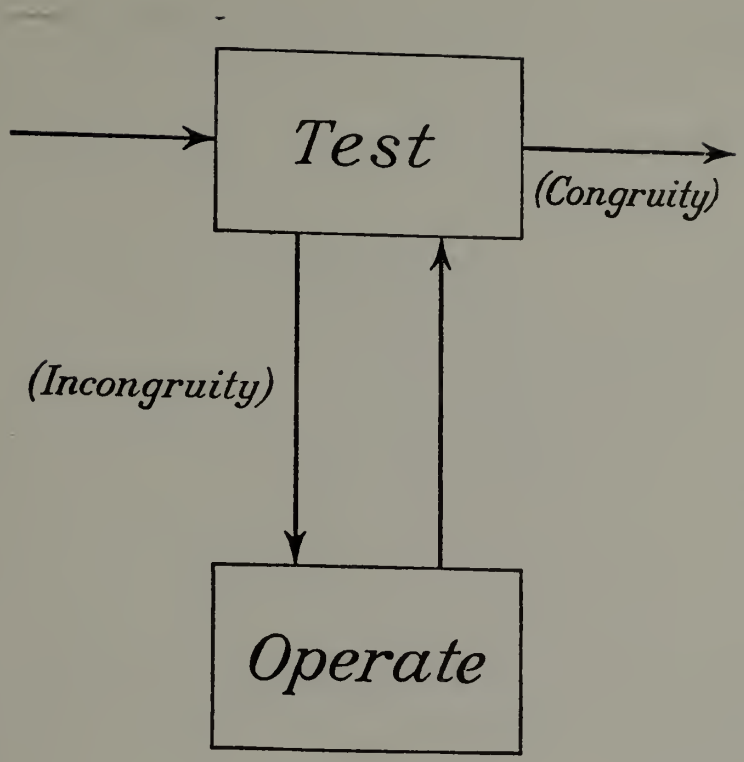
Furthermore, the fact that testing and matching take place in the sensory systems is illustrated by referring to the habituation response. When a person hears the beep of a horn, he orients toward it. If the beep continues monotonously, there is a progressive decrease in response. This is known as habituation. It

is not caused by receptor fatigue, but is evidently mediated by the reticular activating system.

Should the stimulus change even slightly--if the horn becomes softer or stops altogether--then, the initial alerting reactions occur again. Pribram interprets this to mean that:

> the person who has habituated must be matching the current sound against a stored representation of prior tone beeps--why else would a diminution in intensity call forth again the full-blown orienting response?[36]
>
> . . . . . .
>
> . . . the central nervous system must set up a process against which it matches incoming sensory signals. Any change in signal results in the orienting reaction.[37]

Miller, Galanter, and Pribram first redefined a general pattern of reflex action, which is conceived neurologically as a testing of input energies against some criteria established in the organism, and a responding of some kind until the incongruity is resolved. The results of action taken, whether ideational or behavioral, are then "fed back" into the testing phase. They diagrammed this model as a TOTE (test-operate-test-exit) servomechanism.[38]



Label: Figure 5. TOTE Unit.

The arrows can represent energy, information, and control. The authors differentiate between feedback and reinforcement in the S-R sense of the word:

> (1) a reinforcing feedback must strengthen something, whereas feedback in a TOTE is for the purpose of comparison and testing;
> (2) a reinforcing feedback is considered to be a stimulus (e.g. a pellet of food), whereas feedback in a TOTE may be a stimulus, or information (e.g. knowledge of results), or control (e.g. instructions); and
> (3) a reinforcing feedback is frequently considered to be valuable, or 'drive-reducing' to the organism, whereas feedback in a TOTE has no such value.[39]

This scheme is probably one of many higher-order "fictions" that will emerge to help us conceptualize learning. This one does lend itself nicely to the kinds of hierarchical structures which can be said to organize language, concept-building, and the execution of plans. TOTEs can be linked together in various configurations, theoretically to form higher analogue identifying mechanisms. The TOTE model is more appropriate than the reflex arc for conceptualizing a unit that tests information and activates responses according to feedback.

Summary

By beginning at the most basic level of information-processing, the nerve cell network, we have seen that interpretations of nervous system dynamics depends upon which perspective one uses. One way to examine the nervous system is to look at the chemical changes in the cells. Learning may involve a change in the molecular configurations of RNA. Chemists may one day discover a way to facilitate learning through chemical injection. But for our purposes, the molecular approach was seen to have little relevance.

The morphological approach looked at the interactions between nerve cells. Learning, from this point of view, involved strengthening the connections between nerve cells, so that impulses were conveyed more readily

over some pathways and not others. Learning was thus a series of trials and reinforcements. This approach rested upon the reflex arc as a neurological fact. Modern experiments have cast serious doubt upon the reality of the reflex arc.

By adopting a "coding" approach to the nervous system, we can picture the learner not as an obedient responder but as an active structurer of input. We can see nerve impulses not as excitations moving down one-way streets or around reverberating loops, but as signals which are integrated into patterns, just as letters are integrated into words, and words are structured into meaningful sentences.

When a learner examines a new problem, or a new area, he must be organizing masses of stimuli in some orderly way. What processes might be involved? We have identified at least two: (1) all neurological information is coded into discrete units; and (2) discrete impulses are combined and integrated. These neurological processes seem to represent a complementary breaking apart and putting back together. Increased ability to respond can be connected with analogous growth processes--differentiation and integration, analysis and synthesis.

To integrate stimuli into a new pattern, making it stable and recognizable, is to become more attuned to

the environment. To recognize and organize is to bring order out of chaos, to transform confusion into communicable meanings. Learning must involve testing, matching the outcome against stored knowledge, and modifying connections. Knowledge and competence must somehow involve the build-up of new configurations--new codes--rather than the "strengthening of associations." Since digital-to-analogue conversions are so efficient, it would seem likely that we will discover hierarchically organized codes at work in other organic systems.

We have seen two factors which facilitate learning--"arousal" or engagement, and competence. It seems to be a physiological fact that the learner must be interested before he can process information. If he is not competent to deal with new input, if it is unfamiliar or irrelevant, it will be screened out.

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CHAPTER III

EXAMINING THE ENVIRONMENT: SENSORY-PERCEPTUAL PROCESSES

We want to construct a picture of how learning takes place. We have postulated that learning is the increase in ability to respond effectively to the environment through the acquisition of knowledge and competence.

Here we will begin to focus on knowledge, which can be defined as meaningful information. How does an individual react to stimuli so as to derive meaningful information from them? What factors facilitate the growth of knowledge?

Information was defined as organized input. Meaningful information is input that is not only organized but related to a useful cognitive structure within the organism. We will explore various types of cognitive structures in subsequent chapters.

By using a "coding" approach to the nervous system, we put forth three premises that relate to the processing of information: (1) neurological information is coded into discrete units; (2) discrete units (impulses) are combined and integrated; (3) digital-to-analogue conversions are efficient and can be hierarchically organized.

The other three premises relate to the facilitation of learning: (1) the organism must be competent to receive various types of input before it can process that input; (2) before information can be transmitted, the organism must be aroused; (3) the organism becomes more attuned to the environment by learning to recognize new patterns.

By focusing on the sensory and perceptual processes, we want to clarify and extend these premises. We want to ask how these systems operate in order to help us examine our environment and our experience.

We will present two premises which are parallel to those in Chapter II: (1) Sensory input is "broken up" or differentiated by sensory receptors; (2) parts are combined or patterned by perceptual organizers.

We will also present three major premises which extend the first six: (1) increased ability to respond involves the development of structures which examine input in more discriminating ways, and organize responses in more efficient ways; (2) the organism exercises selectivity based on its own criteria of relevance; (3) the conscious use of coded organizers facilitates meaningful examination and reporting.

The Development of More Sensitive and Efficient Structures

N. L. Munn stresses the importance of structures

for psychological development.

> Sensitivity evolves with the evolution of structures responsive to stimulating aspects of the environment. As visual, auditory, and other specialized receptors arise, the organism is better attuned to its surroundings, hence can be influenced by environmental details and can more readily adjust its behavior to changing circumstances. Motor dexterity, or facility in moving around in and changing the environment, is also basically structural. . . . the evolution of ability to profit from past experience, to learn new modes of adjustment, to remember, to think, and to reason, is also at base structural. It depends on receptors (for information), effectors (for execution) and above all on central nervous structures, especially those of the brain (for retention, elaboration, and direction).[1]

The one-celled amoeba is capable of making only generalized responses to stimuli. When any part of the cell conducts impulses, the whole cell reacts. The whole cell moves. It flows toward or away from the source of stimulation. It has a non-specialized neural net. The evolution of higher forms of life has been marked by more and more specialization of the primary functions of sensitivity, conductivity, and movement.

The jellyfish is a more complex being than the amoeba. It possesses a slightly more sophisticated neural net, which is the beginning of a nervous system. Yet it can still react only in a generalized way, since stimulation of one fiber sends impulses to all parts of the animal.

Further up the scale, we find creatures like the sea anenome, which have evolved to a point where specific receptors are connected to specific muscles. The sea anenome has developed the "sense" not to waste its energy until it detects a specific reason to do so. Thus the jelleyfishes and their relations must float back and forth, at the mercy of every current, whereas in the higher order vertebrates, the increased organization of reflexes allows for goal-directed behavior.

In man, we see that the nervous system has evolved to include a highly sophisticated set of structures. This means that when he looks at the world, man does not see amorphous shadows. His eyes have become able to see shapes and colors clearly. He has acquired the ability to differentiate between things on the most superficial level, when he registers things "at a glance." He extends this skill when he studies something. When he examines a new object, he differentiates between its attributes--color, size, shape, markings. When he examines a new environment, he examines it by first experiencing its gross characteristics, then looking more closely at its finer dimensions. He sees not only trees, homes, people, motions, but later, kinds of trees, styles of homes, types of people in different roles, motions that make sense. His ear differentiates automatically between

sounds, but he can acquire much finer discriminations by concentrating and training his ear. His skin senses different textures and temperatures, and if he needs to, if he becomes blind for example, he can increase the sensitivity of his touch. Increased sensitivity involves the use of structures which are more and more "specific"--able to make finer and finer differentiations.

Selectivity is determined by criteria of relevance.

Increased responsiveness means not only the growing ability to see and hear more specific things. It also means the ability to select what to see and hear. Man pays special attention to things that are relevant to him. In animals, structures have evolved which are automatically selective. That is, eyes and ears have developed mechanisms which focus automatically on shapes and sounds which have relevance.

For example, an experiment by Lettvin, Maturana, McCullough and Pitts recorded the activity of single fibers in the optic nerves of unanaesthetized frogs.

> Each fiber in the frog's optic nerve seems to have its own 'receptive field.' . . . The frog's fibers turn out to be quite selective in the kind of stimulation which must appear in their receptive fields to produce a response. One type of fiber, termed a 'net convexity detector' (or less formally as a 'bug perceiver') responds if a small dark object becomes stationary in the field. Such fibers do not respond to large moving

> edges, nor to changes in the overall illumination. Other fiber types found included 'sustained contrast detectors,' 'moving edge detectors,' and 'net dimming detectors.' All of them have rather obvious significance in the life of a frog, as he catches flies, escapes from looming shadows of predators, and the like.[2]

Galambos tapped and wired a cat's auditory nerve to an amplifier, so that impulses passing from the cochlea to the brain were directly recorded. Initial impulses were caused by the sounds of a metronome. These impulses diminished and ceased altogether, however, when the cat was presented with a mouse in a glass jar.[3] While stimulation is first received at the periphery, stimulus selection is centrally controlled. The cat chose to "turn a deaf ear" on the metronome as soon as he had something more biologically relevant to attend to.

In man, acceptance or suppression of input begins at the peripheral organs, but a good deal of control is exercised by higher structures in the central nervous system. The discovery that receptors were controlled to some extent by efferent fibers leading downward, coupled with the knowledge that neural and receptor tissues are spontaneously active, regardless of external stimulation, dealt another blow to S-R theory. Higher organisms are not passive hunks of cell tissue. The organism acts before it reacts, controlling what will constitute

stimulation and what will not. Attitude and expectation play important roles, as do the consciously selected (or unconscious) frames of reference used to filter the input. Auditory localization--the ability to "follow" a conversation that one is concentrating on, even though the background noise may be considerable, is partly inborn. A baby can move its head toward the source of a loud noise.

Other criteria of relevance may serve to "filter out" some noises into the background, as for example when we concentrate on one instrument playing in a symphony orchestra, or one voice at a party. This so-called "cocktail party effect" is not merely a function of the sensory system, but of perceptual processes, governed by centers in the brain. If we listen to a tape recording of our party, the fascinating conversation that we chose to single out without attention has disappeared into the din.

We must now distinguish between relevant and irrelevant sensory information. Irrelevant input does not reach the perceptual staging areas in the brain, where it can be assembled, recognized and identified. As D. O. Hebb points out:

> . . . the mammal's cortex is constantly screening out sensory messages from the sense organs: from the pressures on all

> parts of the body that are touched by clothing and the change in those pressures with every movement, from joints and muscles reporting to the brain the position of limbs, the constant information being received from all parts of the visual field as long as the eyes are open, the constant background noise received by the ears. Not one per cent of this information is responded to, or enters awareness (that is, it does affect the ongoing thought process).[4]

What constitutes relevant information? We can discern at leart two criteria: (1) a stimulus event must be so novel, exciting, or threatening that it produces orienting and arousal, or (2) the individual must choose to attend to some aspect of the environment--he must be "engaged." Physiological changes that occur during the orienting response indicate that the organism may be preparing for action. Some testing and matching device has activated a signal which translates as "Take notice! This sight or this sound relates to you, your growth, your survival, your equilibrium!" A personal connection must be made before an individual will focus on something, thereby setting in motion the differentiating, relating and integrating which must underlie learning. We will go on to explore how these processes operate with a great deal of autonomy, once they are activated.

Input is "broken up" or differentiated by sensory receptors.

The eye and the ear are most important for learning. Both are structured so as to "break" the environment into parts. Receptors are specific. They respond to one particular kind of energy. The 37 million rods in the retina are nerve cells sensitive to differing low light intensities. The one million cones respond selectively to different wavelengths, enabling color vision. "Association" cells run across the retina, stimulating or inhibiting certain retinal cells in order to sharpen the discrimination. Information is clarified and refined as it is relayed into the cortex, primarily through a contrast enhancement process. The eye separates the world into light and dark, line and curve, red and green, figure and ground.[5]

The ear acts as a frequency analyzer when different sound waves reach the inner ear. Auditory nerve endings in the cochlea are specific for different tones. Thus one fiber in the basilar membrane will vibrate to a C sharp, while its neighbor remains still until a D natural is sounded. Complex sounds excite an ensemble of nerve receptors, which relay not only the tonal frequencies but also their intensities, regardless of whether a voice or an instrument produced it.

Experiments have suggested that the more clearly differentiated the parts are, the easier it is to remember an ensemble of stimuli. Conrad and Hull found that it was harder to memorize strings of seven letters if the letters sounded alike. Therefore, SFSXXFS was harder to recall than DFQLYDN.[6] We may assume that this was true because it was harder to differentiate and name the letters in the first string, since they all sound alike.

The fact that it is easier to remember letters at the beginning and end of a string also suggests that contrast enhancement is an aid to memorizing. Letters at the beginning and end of a series "stand out" more clearly because of the whiteness of the background surrounding them, making differentiation easier.

The eye and ear have developed contrast enhancement mechanisms in order to help us break up the environment. Apparently there is a reason for this. Breaking it up, perceiving parts and differences, enables us to somehow relate it to our internal cognitive structures more efficiently.

Parts are combined or patterned by perceptual processes.

Assuming that we are attending to stimuli, the sensory information will be "assembled" by perceptual processes. Just as discrete nerve cell firings are averaged or integrated at the junctional microstructures

to form graded patterns, the mosaic excitations which are broken up in the cochlea are organized into ensembles, into sub-wholes:

> . . . and what we perceive in vision is not the camera-image on the retina but the 'inferential construct' of people and objects which preserve their constant shape and size, regardless of angle and distance. The eye may be a camera, but immediately behind the lens there is a series of compensating, correcting, and retouching devices--the perceptual matrices of skilled vision.[7]

Just as the sensory mechanisms display a degree of autonomy (they are "programmed" for stimulus-specific selectivity), the perceptual mechanisms seem to show an affinity for aggregates, patterns, schemata, "digital" processing changes to "analogue"; bits become interrelated into closed figures or rhythmic cadences whenever the organizing centers can find a way to impose order. Feature analyzers may become connected into loops within loops, parts within wholes.

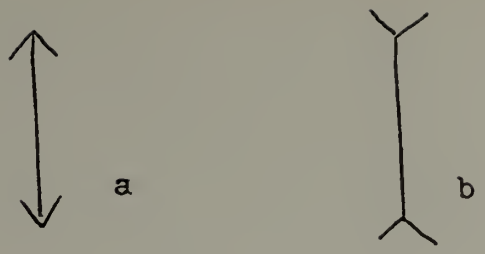
One famous experiment demonstrates that the perceptual processes combine parts into a whole. In 1952 both D. W. Ditchburn and L. A. Riggs discovered that artificially stabilizing an image on the retina produces a strange effect. Visual perception, like tactile, auditory and gustatory (taste) sensation, seems to depend upon tiny motor reactions as well as individualized mediating processes; to perceive strange sounds, organisms move

their heads or ears; smelling involves a change in breathing or sniffing; these motions apparently aid rapid testing and feedback.

Normal vision always involves eye tremors. By mounting a small target on a short stalk fastened to a contact lens, the image can be "stabilized," since the target moves with the eyeball itself. Experimentors found that the image will disappear and reappear, often disintegrating into parts. The reappearing fragments are always "meaningful" sub-wholes; if the target is a geometric figure, then its sides reappear as separate entities; if the target is a profile, features are grouped, so that first the top of the head appears as a unit, then the forehead area, then the neck and chin, etc.. Visually perceiving an object may seem like a simple, unitary event, but actually a complex integration of parts must take place, apparently facilitated by the scanning eye movements themselves.[8]

The arrow illusions shows that our perceptual systems automatically impose a perspective on the outside world. This is another instance of patterning our impressions of the environment so as to reduce the mystery and incongruity.

a = b



> This particular illusion appears to those of us brought up in a rectilinear world of lines and corners, the two-dimensional arrows immediately suggesting the three-dimensional arrangement of a cube . . . . The arrow with outward-going fins suggests the distant corner of a room while the arrow with the inward-going fins suggests the nearby corner of a building. We realize that distant objects appear smaller than they really are and mentally adjust for the apparent distance between the two corners. We therefore perceive the arrow with the outward-going fins to be longer than it really is. People brought up in curvilinear societies (round buildings, etc.) do not have this illusion and report that the shafts of both arrows appear to be the same length.[9]

This patterning helps us to adjust to features that we constantly come in contact with, and also facilitates identification, recall and interpretation.

What other kinds of patterning do we impose on our environment to help clarify it? We can identify at least three: naming things, grouping things, and using analogue codes.

Information processing depends on the ability to name things. Letters flashed on a tachistoscope are more easily recalled if there is enough time for the subject to "identify" it. Attentive synthesis, according to Neisser,

takes about 100 msec.; if no other disturbing input appears, the subject can synthesize a visual object as well as a linguistic-auditory one.[10] Before that time, the subject notices something (he can give a quick, non-discriminating motor reaction) but until he identifies it, as a letter or word, and names it, he will not be able to remember what it was. Recall is also enhanced if the subject is "set" to encode the images in a certain order, and if the subject is interested in what he's doing.

Stimuli become easier to deal with when they are grouped into recognizable wholes. Thorndike formulated the principle of "belongingness" when he found that his subjects had a hard time "associating" the last word in a sentence with the first word in the next. Words that are organized into a recognizable pattern (e.g. a sentence) are more easily memorized, since the pattern is taken in "as a whole."[11]

When long strings of numbers, nonsense words, or events are presented to people, the "digital" sensory processes quickly focus on each one. The string looks unintelligible, especially if it is long and there is no discernible pattern. For example, it is hard to find meaning in phrases like:

INMUDEELSARE
INCLAYNONEARE
INPINETARIS
INOAKNONEIS

But when we impose segmentation, making "chunks" of letters (In mud eels are, etc.), they become easy to comprehend and remember.[12] This is another example of grouping.

A number sequence like:

1 4 9 1 6 2 5 3 6 4 9 6 4 8 1

becomes easy to remember if we "code" it as an analogue abbreviation--"the first nine squares."

When the task becomes more complicated, as for example when a subject is given some words, letters or numbers to memorize, he needs to "rehearse" them. Repeating them seems to make them more resistent to forgetting. Sanders points out that:

> . . . it seems doubtful, however, whether this improvement results from the rehearsal in the sense of mere automatic repetition. . . . The main activity of the organism during the rehearsal period seems to be the assimilation of the material by means of interpretation, imposition of rhythms, finding of rules, etc.[13]

Why should the use of rhythm, grouping, or patterning be an aid to memorizing, recognizing, and information-processing?

The key seems to be that the learner creates a structure, or makes use of an already existing one. The brain builds or inherits a context, within which discrete data can be placed, and from then on, the coded analogue helps determine what is perceived and how it is reported to others. Rhythm exists at all levels in the human body,

from the frequency intervals in the nervous system to the pulsating of the heart. Rhythm is a pattern, a set of relationships or ratios, which can be mathematically specified, as it so obviously is in music. Once the pattern is initiated, it can run "automatically," providing a set of reference points, a "whole" that the initiator doesn't need to think about, but which lends support to the organization or creation of variations.

> The parts (individual beats) get their meaning (relative position) from the whole, even though that whole does not exist at any moment of time. It exists, as one might say, in the subject's mind, as an intent, a Gestalt, a plan, a description of a response that can be executed without further consideration....Spoken language is built upon 'syntactic' organizations of this sort.[14]

A word about the Gestalt approach to perception is appropriate at this time (the Gestalt school of psychology was developed by Max Wertheimer, Wolfgang Köhler, and Kurt Koffka). Gestalt principles of perceptual organization derive from the law of isomorphism, which states that there is no one-to-one relationship between stimuli and percepts, but that the form of experience corresponds to the form or configuration of the stimulus pattern.[15]

The Gestaltists believed that the perceptual processes spontaneously and automatically separate the visual field into a figure that stands out from a background. The

principle of prägnanz states that these figures tend to become organized into "good Gestalten"--symmetrical, meaningful forms. Thus four disjointed lines may be seen as a square; objects that are close together become grouped; vague figures become defined or clarified; gaps are closed whenever possible. The impulse to form wholes is innate, according to the Gestaltists.

Furthermore, these wholes tend toward "equilibrium," like magnetic force fields. When the psychological field is "disturbed" by new data, the whole undergoes a realignment of forces until equilibrium is re-established. The law of transposition would be understood immediately by pianists who play by ear. It states that once the pattern is established, it can undergo changes without losing its identity. Hence a tune transposed to another key remains the same tune, even though the individual components (notes) are different. Discrete bits are not chained together. Instead, the perceiver can initiate the whole pattern, once the interrelationships are organized. But in order to be connected, the parts must first be focused upon and differentiated.

Gestalt theorists were among the first to systematically stress the importance of patterning. They emphasized differentiation in terms of separation of figure from ground. They suggest that the configuration is more important than the discrete bits, or the "raw data."

The conscious use of coded organizers facilitates meaningful examination and reporting.

We are attempting to establish a picture of how people examine their environment. We can begin to list some components of the initial "data-gathering" process, based on the preceding sections. What does a human being do when he consciously sees and hears:

(1) He selects some things to attend to and not others.

(2) He differentiates between things.

(3) He patterns what is seen or heard.

The patterning process is crucial. It is here that he establishes the configurations, just as the junctional microstructures in the nervous system integrate discrete impulses into analogue patterns. By consciously naming, grouping or placing in context, the learner is intentionally coding what is perceived. A "code" was defined as (1) a set of rules, and (2) a set of signals which have certain meanings. We wish to imply that once a pattern is established, the learner can use it to organize future selectivity and differentiation.

Two examples illustrate this. The first is a hypothetical instance of a self-directed learner undertaking a project. A senior majoring in Journalism/Sociology wants to work for three days a week in a day care center, to test

whether this is a potentially satisfying career. She has little knowledge of the terminology of Education. During her first few visits, she makes gross differentiations about what is going on. She sees children, teachers, objects and sequences of events. Some things stand out more than others. She can report dozens of scenes and details, analogous to the discrete parts of a whole impression. But until she begins to group impressions and create names for her areas of interest, the discrete parts have little meaning. They cannot be organized and related to a useful context.

Eventually, she looks at all the interactions between the children and begins to see them as examples of "learning social skills." This is a focus that she can use to organize future thinking and observing. Other organizers might be "preparing lesson plans," "maintaining discipline," or "implementing values of the school." The student who does this kind of "naming" is in effect coding a large number of disconnected observations. The coded organizers act as analogues--they signify a whole class of digital, concrete details.

Why is it helpful to group or code the concrete elements of a new experience or a new environment? The answer must be that it enables more efficient communication and more meaningful learning. It not only allows

greater selectivity by providing a means for focusing on some events as relevant to an organizing concept, but it also enhances the usefulness of other frames of reference. For example, the student can select the sub-area called "maintaining discipline," "energize" it by introducing a conflict ("Should I be authoritarian or non-directive?") and expand its meaning by placing it within various frames of reference (e.g. "the way I was taught," "what John Dewey says," "how much structure is best for three-year-olds," etc.). When a student begins to consciously look beyond the concrete, objective aspects of an experience, he moves into an "analytic" mode of examination. This will be explored later.

Let us emphasize the obvious fact that the conscious use of coded organizers facilitates meaningful examination of the environment. It also facilitates communication about what is experienced. Examination is a personal, internal process. Reporting is the behavioral manifestation of what is perceived. The code used to shape the reporting of data can distort reality as well as clarify it. For example, Arthur Koestler summarizes the ways in which artists of various periods have used a coded organizing concept to selectively portray the human body. It implies that the manner in which an image is perceived and portrayed depends on the code which is functioning,

patterning vision according to specific criteria of relevance.

> On Egyptian wall-paintings and reliefs, conventionalized andschematized figures are shown functioning as fishermen, hunters, builders, servants, or parts of a state procession. The size of the figures is usually proportionate to their rank--not to bodily but to social stature; the male skin is painted dark brown, female skin pale yellow; the code which provides the criteria of relevance is not visual but conceptual. For three thousand years the sculptors and painters of Egypt produced no original discoveries in the techniques of visual representation. They had no visual curiosity. In its indifference to color, movement, human anatomy, Egyptian painting was more singlemindedly functional than any before or after; but 'function' was defined as social function, a person's rank and occupation in the social hierarchy. Apart from that, individuals are interchangeable, without personal identity, and their appearance devoid of interest.
>
> In the golden age of Greek art, the human body was seen in a totally different aspect, that of its physical function: in throwing a disc, tying a sandal, or simply lifting an arm; vision is attuned to geometrical proportion, to the play and coordination of muscles and joints; and by the criterion of a perfect physique, with facial expressions limited to types, the curve of the buttocks becomes as important and expressive as the curve of the brow. Again, in Byzantine painting the human body functions as an indifferent, and often awkward, shell of the spirit; and if the spirit commands the saint to bend his head back and gaze rapturously into the sky, the artist has no qualms in breaking his neck and letting his body float upward with limbs all out of joint. The Renaissance once more gave the body its due; and in the centuries that followed it became the carrier of an individual head,

> and hence of expression and mood. For the courtiers of Louis XV, the principal function of human bodies was to play, suitably covered and uncovered, hide-and-seek between trees and bosquets, and to fall into each other's arms. For the impressionist painter, the function of the body is to demonstrate the impermanence of appearances in luminous blurs and colors; for the cubist, to prove God's preference for cubes; and so on..
>
> Which aspects of reality dominate the visual matrix of a culture or group depends ultimately on its conception of the purpose and meaning of existence. Accordingly, its norm of beauty will always reflect the archtype of some kind of functional perfection: the rigid dignity of the Pharaoh, through whose eyes eternity looks in stony silence at time; the play of muscles in the Greek adolescent's perfect anatomy; the spirituality in the transfigured face of the Byzantine madonna; the harmonious resolution of the body into Euclidian forms, or a patchwork of colored blobs. Whichever aspect is dominant, its matrix acts as a kind of optical polariscope, through which the particular appearance is seen as a thing of general significance, an embodiment of some universal law or meaning.[16]

Summary

What kind of a picture is emerging with regard to our basic questions? We want to conceptualize what learning is, how learning takes place, and what factors facilitate it. Let us regroup our premises under some key concepts.

I. Knowledge and Competence

A. Increased ability to respond involves the development of structures which examine

the input in more discriminating ways, and organize responses in more efficient ways (Ch. III).

1. The organism becomes more attuned to the environment by learning to recognize new patterns. This involves testing, matching, and modifying (Ch. II).

2. Digital-to-analogue conversions are efficient and can be hierarchically organized (Ch. II).

II. Processes Connected With Gaining Knowledge

A. Selectivity

1. The organism exercises selectivity according to its own criteria of relevance (Ch. III).

B. Differentiation

1. Neurological information is coded into discrete units (Ch. II).

2. Sensory input is "broken up" or differentiated by sensory receptors (Ch. III).

C. Patterning

1. Discrete units (impulses) are combined and integrated (Ch. II).

2. Parts are combined or patterned by perceptual organizers (Ch. III).

III. Factors that Facilitate Gaining Knowledge

A. Engagement

1. The organism must be "aroused" before information can be transmitted (Ch. II).

B. Competence

1. The organism must be competent to receive various types of input

before it can process that input (Ch. II).

C. Use of Coded Organizers

1. The conscious use of coded organizers facilitates meaningful examination and reporting (Ch. III).

Footnotes to Chapter III

[1]N. L. Munn, The Evolution and Growth of Human Behavior 2d Ed. (Boston: Houghton-Mifflin, 1965), p. 14

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[5]Vander, Sherman and Luciano, Human Physiology, pp. 509-539.

[6]R. Conrad and A. J. Hull, "Information, Acoustic Confusion and Memory Span," Brit. J. Psychol., 55 (1964), pp. 429-437, cited in Neisser, Cognitive Psychology, p. 223.

[7]Koestler, The Act of Creation, p. 527.

[8]Hebb, Textbook of Psychology, pp. 239-242.

[9]Vander, Sherman and Luciano, Human Physiology, p. 538.

[10]U. Neisser, Cognitive Psychology (New York: Appleton-Century-Croft, 1967), p. 103.

[11]Chaplin and Drawiec, Systems and Theories of Psychology, p. 209.

[12]Pribram, Languages of the Brain, p. 342.

[13]A. F. Sanders, "Rehearsal and Recall in Immediate Memory," Ergonomics, 4 (1961), p. 33, cited in Neisser, Cognitive Psychology, p. 223.

[14]Neisser, Cognitive Psychology, p. 235.

[15]Chaplin and Krawiec, Systems and Theories of Psychology, p. 142.

[14]E. Saltz, The Cognitive Bases of Human Behavior Homewood, Illinois: The Dorsey Press, 1971) p. 114.

C H A P T E R IV

CONCEPT LEARNING

In this chapter we will continue to explore the acquisition of knowledge through looking at concept learning. Our main purpose is to elaborate upon the major premises stated previously, and to differentiate between two modes of learning: (1) data-gathering or "static clarification" and (2) analysis or "dynamic relating."

We will see that selectivity, differentiation and patterning are processes that help us clarify the nature of "things." When we notice a new "thing," we unconsciously ask "What is it?" To increase our knowledge, we make discriminations about its parts, usually its concrete components or attributes. But we may also clarify it by naming, abstracting or categorizing it. These are other ways of patterning the input.

Static clarification is facilitated by competence within the learner (which in this chapter is connected with the "naturalness" or "familiarity" of the input), engagement (which is connected with functional relevance), and by the use of coded organizers (which are effective when connected with a useful cognitive structure, and are appropriately inclusive).

Our major premises in this chapter are:

(1) The ability to make finer discriminations increases our effectiveness at responding to the environment.

(2) The learning of symbols involves abstracting the essential pattern.

(3) We are more competent at examining stimuli which are natural or familiar.

(4) When stimuli become relevant, we tend to engage ourselves more readily in examining them.

(5) We use different modes of examination to acquire knowledge.

(6) Coded organizers are effective when they are connected with a useful structure, and appropriately inclusive (not too concrete, not too abstract).

The ability to make finer discriminations increases our effectiveness at responding to the environment.

Symbols are representations of reality. They are patterns which allow us to control what is perceived. They enable us to communicate with each other. A symbol is an abstraction--a generalization from many particulars. But which particulars? In order to abstract, we must first discriminate between finer and finer dimensions, separating relevant ones from irrelevant ones.

A look at the imprinting phenomenon clarifies this point. A gosling inherits a code which is basic to its

survival. According to this rule, it must follow its mother. During a critical period in maturation, the code can be triggered off by a very non-specific releaser. The gosling will literally follow the first thing that moves. In its natural environment, the first logical thing to move would be its mother, but in a laboratory, the human keeper is "perceived" as meeting the broad criteria of "goose-likeness."

Once this "imprinting" has occurred, the gosling will follow only human beings--not dogs, cats or other geese. Perceptual learning has occurred. The gosling has learned to discriminate between human shapes and other moving shapes, and eventually, it will acquire a finer filter, learning to follow only its keeper. Certainly humans must look as much alike to a goose as geese look alike to us. In fact "all Orientals look alike" until we acquire finer filters--finer perceptual matrices. A visual field which is undifferentiated yields no information.

> Native equipment and early learning provide the basic foundations on which the different hierarchies are built, designed to filter out more and more sharply defined features. The coarse-meshed 'perceptual sieves' of the tyro acquire fine-meshed sub-analysers: perceptual learning progresses from the seeing of gross differences to the seeing of fine differences. All connoiseurship--from the chicken-sexer's to the handwriting expert's, from the wine-taster's to the art historian's, depends on the hierarchic build-up of analysing, matching, scanning codes which extract subtle similarities and make precise discriminations.[1]

Somehow the gosling has screened out the irrelevant characteristics and abstracted a picture of its keeper. In the same way, we humans build stable concepts by screening out the accidental accompaniments to the invariant pattern. We strip down the input by differentiating between important and non-important details. For example, to a child, there are many types of fathers--tall ones, short ones, handsome ones, funny ones. The child must abstract from all these attributes the two crucial codes--"male" and "parent."

Highly correlated attributes may resist this filtering-out process, especially if the culture reinforces the connection. For example, Saltz and Hamilton found that eight-year-old children will often deny that a male parent is a father if the attribute of "goodness" ceases to be included.

> A father goes to work. On the way home from work in the evening, he stops at a bar to have a drink. His friends there are drunkards and he becomes a drunkard too. Is he still a father?

Eight-year-olds will often say "No." Five-year-olds will deny that a "father who goes to work where he is a doctor" is still a father, whereas eight-year-olds no longer have difficulty with this differentiation.[2]

Eventually, we learn to sharpen our perceptual analyzers. We build stable, invariant concepts against which incoming input is matched. Two percepts are considered "the same thing" if they meet the criteria of relevance in a

given hierarchy, according to the rules of the game being played at the time.

> The answer to the old classroom question whether a red circle is more similar to a green circle than to a red triangle depends on whether I am teaching geometry or colour-theory. In the first case, the two circles are for my purpose 'the same thing'; in the second, the two colours are 'the same thing.'[3]

The learning of symbols involves abstracting the essential pattern.

In 1920, Hull conducted an experiment in which subjects were asked to learn concepts associated with Chinese characters. He concluded that subjects learn to discriminate the common element in the characters.[4] This conclusion is in agreement with Koestler's view of concept learning as a process of "departicularization," or abstracting the essential, invariant pattern.

The word "dog" to a toddler may signify (representationally) his own pet. To a pre-school child, "dog" has become (conceptually) a word which refers to all dogs. After the pre-school years, the meanings of new words are learned when definitions are provided, or when they are encountered in stable contexts. Concepts are on a higher level of abstraction than concrete word names, just as word-habits in typing are on a more inclusive level than letter-habits.

The more abstract a concept is, the more difficult it is to learn. This is probably because there are more

component parts, more concrete derivatives. Heidbreder investigated the learning of various types of concepts, including concrete objects, spatial forms, and abstract numbers. She concluded that there was an order of "dominance" in human thinking, the concrete concepts being the easiest to learn (presumably since they are the ones learned first in childhood and the ones which occur most frequently in everyday life) and abstract being the most difficult.[5]

We are more competent at examining stimuli which are natural or familiar.

Concrete objects are more familiar than abstract concepts. We see them and touch them every day. But are some patterns more easily recognized than others? If so, what makes them easier to recognize? What makes us more competent at recognizing them?

As humans, we tend to recognize those patterns which are already coded in our cognitive structures. We retain those parts of a visual field which are meaningful, which can be related to some context that is already familiar to us. A simple demonstration is provided by the following exercise:

> Below you will see 18 words, 9 of them real words in the language and the other 9 nonsense words. You will read each of the words once and go on to the next word. After you have read the entire list over once, you will be given a recognition test on these

items. Remember, read each word to yourself once, then go on to the next word.

LAW	BUG	TEN	DIY	LER	GAC	JAB	PET	MUD
BEJ	TUZ	MOF	CUT	HAS	SIP	POB	FEH	HAX

Now cover the words above so that you cannot see them and let us find out how many you can recognize below. In the recognition test below you will find pairs of words that are identical except for one letter. One of the words in each pair will be a word that you saw above. Check the correct word in each pair.

BAG	LOW	JAB	MAF	DIY	TAZ	TEN	CUT	MAD
BUG	LAW	JOB	MOF	DUY	TUZ	TIN	COT	MUD
BEJ	POB	LIR	HAS	SAP	POT	FAH	HAX	GAC
FIJ	PEB	LER	HIS	SIP	PET	FEH	HOX	GIC

Explanation

Most people will have much more difficulty recognizing unfamiliar stimuli, upon seeing them for a second time in the test above, than recognizing familiar stimuli. The unfamiliar stimuli seem to be more easily confused with one another. Familiarity appears to increase the discriminability of stimuli.[6]

On the other hand, the concept of "naturalness" may also be a factor. For example, a newly-hatched chick pecks at every edible crawling object. Upon pecking the cinnebar caterpillar, it will reject it immediately and avoid it by sight forever after.[7] It has learned a new skill--the avoidance of caterpillars--after only one trial, whereas the dog, with much greater intelligence, will take many weeks to learn to distinguish between the food-signal values of a circle versus an oval.

One plausible explanation for this difference is that caterpillars belong to the natural environment of the chick. Through evolution, its perceptual structures have inherited an attunement to biologically relevant input, so that it is more quickly analyzed and synthesized. Circles, gongs, bells and metronomes are not, however, part of the dog's natural environment. It would logically take much longer, therefore, for his whole perceptual hierarchy to readapt itself to attend to bell sounds, which have heretofore been automatically screened out as irrelevant.[8]

Experiments in concept-learning typically involve presenting arrays of items, colors, shapes, etc. to a subject who must then determine, through testing various hypotheses, which concept the experimentor has in mind (e.g. the concept of "redness" or "triangularity"). Forms and colors are natural things in our human environment. If we were asked to distinguish between the scents of various animals, we would have considerably more trouble, but this would presumably be a more accommodating test for dogs.

<u>When stimuli become relevant, we tend to engage ourselves more readily in examining them</u>.

As children, our discriminating and abstracting is governed by the criterion of functional relevance. We name

object and action concepts first that are most functionally relevant. Just as "shapes that move" is the guiding coded attribute for the gosling to look for, "large shapes with deep voices" may be the relevant pattern connected with fathers. Since the color, age, facial expression or income of the father is not relevant to the infant, those dimensions will not be discriminated. The principle of relevance applies as we grow older. If we fail to observe differences, it is because we lack the equipment to "be discriminating," or we fail to question the environment. Thus the Eskimoes name several different types of snow, and rock music fans can identify the names of the bands after the first few bars, even if their parents may perceive it all as "noise."

We use different modes of examination to acquire knowledge.

Babies are prone to spontaneous babbling. In fact, all babies tend to babble alike, whether they are white, black or oriental. At six months, however, their sound patterns begin to resemble those produced by nearby adults. Correlations between sound patterns and objects are gradually stamped in, until the child discovers that everything has a name. Koestler stresses the importance of the "naming question" in early language behavior. The child asks "What's this?" about everything and is visibly satisfied to receive an answer.

The exploratory drive has emerged, and so has the expectation that a thing should have a name. Without a label it is incomplete. As adults, we feel this urgency when we learn to use a language in a foreign country; we need to know the German or Russian or Japanese name for everything of importance. Slowly the child builds up a "representational" vocabulary, consisting of word-symbols which are equivalent to specific, concrete things.[9]

Later, words begin to represent concepts--unitary meanings which signify a class of objects with common properties. We learn to generalize from many particulars.

Children gradually learn to differentiate words according to grammatical categories, discovering that finer lables enable finer control. Until a certain stage, there is no distinction between attributes and causal relationships.[10] The realization that "all things have causes" must be as powerful as the discovery that "all things have names". The questioning mania reappears, and the content of the answer given to the "Why?" question is often less important than the satisfaction bestowed by an explanation.

Thus we build symbol systems which involve "static" realities by finding out the names of "things." Concepts are more abstract "things." They are also coded analogues. As general terms, they signify numbers of specific, concrete units. When we make a "static clarification," we gather

data. We identify things (nouns and pronouns) and categorize them.

But when we relate symbolic units to each other, we move into a more "dynamic" mode of looking at the environment. To understand how to cause is to understand how to control. We begin to work harder at explaining things, not just naming and describing them. A sentence that deals with dynamic relationships typically has a subject and an object with a transitive verb in between. It is often more interesting and more difficult to grasp. We are looking not at the parts of a single unit, not at the differences between two units (static comparison), but at the way in which one unit causes or affects the other, or augments its meaning. We must deal mentally with independent (cause) and dependent (effect) variables. We are concerned with changes--how one thing changes another--its concrete reality or its abstract meaning.

What other kinds of dynamic relationships can we name? Any number of transitive verbs come to mind: include, exclude, imply, represent, modify, multiply, divide, love, hate, translate, evaluate. All involve <u>connections</u> between symbol systems. To examine the environment by relating things is to use a mode of inquiry which is fundamentally different from the data-gathering mode (selecting, differentiating, patterning). It can be called an "analytical" mode. According to Bloom:

> Analysis emphasizes the breakdown of the material into its constituent parts and the detection of the relationships of the parts, and the way they are organized.[11]

We are stressing the "relationship" part of this definition.

Coded organizers are effective when they are connected with a useful structure, and appropriately inclusive.

Coded organizers in this sense deal with content. They are sets of signals which have certain meanings. As organizers, they have the qualities of analogues. When they are used to determine the examination or reporting of knowledge, they deal with process. It is then that they function as "rules."

First, what do we mean by "useful structures"? It is convenient to picture mental organization as a hierarchical affair. The more abstract and inclusive a concept is, the "higher" a level it occupies in language. Thus "fruit" is higher (more abstract) than "banana." The word "abstract" comes from the Latin word "abstrahere"--to draw from or separate. Thus the abstraction is "drawn out of" the concrete object or event, separated from the real thing when the essential attributes are perceived. But which attributes define the abstraction depend on the criteria of relevance being applied.

Every student has a different cognitive structure. The content and organization will vary. Content consists of facts, concepts and propositions, defined according to the

person's own experience. Content will vary in its clarity and stability, in its size, in its sophistication. The counselor must work to understand each student as if every one were speaking a different language. This involves continuous testing, matching and feedback. In order to move from a concrete reporting of facts to an analytical examination mode, the key concepts, the organizing, filtering structures must be identified and clarified.

The use of symbols or names gives stability to my retained knowledge. The definitions and connotations may change, however, as the meanings of words evolve erratically down through time.

> My concept of a 'gene' or a 'seductress' or of 'President Eisenhower' is certainly not the same as it was ten years ago, though the verbal label attached to each of these concepts has remained the same. It is strange to reflect that a major part of our scientific and philosophical vocabulary consists of old Greek bottles filled and refilled with new wine; that 'electron' once meant a piece of amber, and Homer's 'cosmos' a flat disc covered by a vault. It is even stranger that the same Sanskrit root 'matr' split, by mitosis, as it were, into 'maya'--the oriental's web of illusions, and 'metron', metre, the Occidental's yardstick to measure the world.[12]

Each verbal concept rises to its hierarchic level through the abstracting, departicularization process, and remains fixed, even though the more concrete attributes associated with it may be in a state of flux. The concept becomes part of other verbal matrices, each in turn

governed by a selective code. It has not only a "vertical" place, but also a "horizontal" position. Each concept is a member of many clubs, "and the more there are of these inclined planes in semantic space the richer and more multi-dimensional the concept."[13]

Structures in the mind have great functional importance for all of us. We have learned to use space and time structures to help us function in our environments. When we come to a new place, the questioning impulse begins to work continuously, if not consciously. The representational scheme that we build up can be seen as internalized answers to functionally relevant questions. Our awareness of time passing acts as a pacemaker. We "know" when things are supposed to happen and we make plans accordingly. We learn where things are located in space, internalizing "maps" that stabilize our spatial placing of buildings, cities, states.

We build a picture of our job responsibilities, based on the question, "What am I expected to do?" or "What are the possibilities for accomplishment?" We establish "people structures" by identifying and relating to people who are important to us. We have "memory systems" which can be very vivid depending on the amount of emotional content, and we can locate the context for memorable experiences by activating "place structures

from the past." We develop value systems by discovering what we like and what makes us uncomfortable. All of these connections help determine the ways in which students will pursue knowledge, and they are as important in determining what will be seen, named, defined and related as are academic values that the student has absorbed.

We may hypothesize that bodies of knowledge are structured answers to questions which have (or had) functional relevance to someone at some time. Bodies of knowledge have become codified. They have become the familiar arts and sciences with all their hierarchical subdivisions. These structured collectivized fields of knowledge may or may not have any functional relevance for the students who try to learn about them, but they at least show the ways in which questions have been asked and answered.

Another more abstract structure, can be said to exist in the individual mind as well as in the collective mentality of a culture. For lack of a better label, we will call these "transcendent thematic structures." They consist of unifying ideas or perspectives or values that do not relate to any specific body of knowledge, yet they act as organizers and filterers of information, and hence affect learning. These structures provide the

connections between individual experience and "the human experience," since they synthesize more universal perspectives that men have thought about, written about and fought about for centuries.

They consist of highly abstract concepts pieced together into statements about good and evil, order and chaos, fallibility and perfectibility, power, wealth, love, betrayal, sacrifice--the tragic and timeless aspects of human experience. A theme is always a statement, usually with a belief implied. "Service to others is the highest good." "Power corrupts." "Love never lasts." These are lessons abstracted from countless predicaments, and they almost always evoke an opposing viewpoint.

Themes can be abbreviated and made more interesting by stating them as conflicts: The Individual vs. Society, Free Will vs. Fate, Love vs. Duty, The Outsider vs. the Group, Reality vs. Illusion, etc.. Jung postulated a "collective unconscious" implanted with archtypes or patterns of thought which seem to be stamped into the race. They crystallize in myths and legends which contain the same themes despite widely differing backgrounds--the death and resurrection motif, the struggle to wrest power from the gods and to placate them through sacrifice, the battle between the sexes, the generation gap, the heroic-

but-doomed leader, the tyrant against the rabble, the triumph or defeat of love. Any learning experience that somehow ties into a universal theme, especially if tension is aroused by conflict or emotion is aroused through identification, takes on an extra depth or intensity. Thus Chaucer's "Troilus and Criseide" can strike the same responsive chords as "Love Story," even though the former was written in 1385.[14]

Perhaps it seems odd to use the word "structure" to refer to collections of concepts, values and ideas. We think of structures as solid and concrete, whereas the ones outlined above can only be hinted at and vaguely recognized. The Latin word "struere" from which "structure" is derived means "to heap together, arrange."[15] Structure can mean "the arrangement or interrelation of all the parts of a whole."[16] Therefore, any identifiable structure of ideas represents a synthesis. The end product of learning, then, is some structure, organization, or synthesis which is "new." Life renews itself through the continuous breaking apart and rearranging of elements, and this is what the individual learner does when he concentrates on the world around him.

Themes can work on a less exalted level in day-to-day problem-solving. Any organizing idea can be used to interrelate new perceptions with multi-level cognitive

structures. The discrimination and abstraction skills that we all possess can be effective at translating superficial perceptions into more sophisticated perspectives, or nebulous experiences into clearly understood turning points. We can learn to differentiate the parts of an area of interest by invoking thematic or conceptual dimensions that are "natural" to the learner. For example, to the novice, wine is wine until we introduce a color dimension--red vs. white--a taste dimension--sweet vs. dry--a time dimension--aged vs. new--a locale dimension--foreign vs. domestic. The whole concept (wine) is developed and elaborated using various dimensions to aid the build-up or activation of discriminating filters. The more subcategories become integrated, the faster one learns to judge whether he is tasting a vintage Burgundy or a dry Riesling from the Napa Valley.

How is new knowledge incorporated into various cognitive structures?. We can only speculate. Logically, new data must be associated to existing structures in the brain.

Ausubel emphasizes the importance of "anchoring ideas."

> One obviously important variable affecting the learning and retention of new, logically meaningful material is the <u>availability in cognitive structure of specifically relevant anchoring ideas</u> at a level of inclusiveness

> appropriate to provide optimal relatability and anchorage (derivative or correlative subsumption; superordination).[17]
>
> (italics his)
>
> . . . . . .
>
> Since logically meaningful material is always, and can only be, learned in relation to a previously learned background of relevant concepts, principles, and information which make possible the emergence of new meanings and enhance their retention, it is evident that the substantive and organizational properties of this background crucially affect both the accuracy and clarity of these emerging new meanings and their immediate and long-term retrievability. If cognitive structure is clear, stable and suitably organized, accurate and unambiguous meanings emerge and tend to retain their dissociability strength or availability. If, on the other hand, cognitive structure is unstable, ambiguous, disorganized or chaotically organized, it tends to inhibit meaningful learning and retention. Thus it is largely by strengthening relevant aspects of cognitive structure that new learning and retention can be facilitated.[18]
>
> (italics mine)

This rather exhausting statement reinforces what John Dewey has said, that in learning the student must build upon his own experience. In order to use the concepts that he has, he may need to clarify not only those relevant anchoring ideas, but the ways in which they are organized. Ausubel's choice of rather imposing words like "correlative subsumption" and "superordination" are simply attempts to use this hierarchical model to picture the learning process. What does he mean by these things?

In neurological language, these anchoring ideas or stable concepts could be seen as aggregate clusters or patterns of receiving-transmitting circuits, to which we associate a particular auditory, visual, or vocal name. When new information is processed, we may say that it is tested for relatability and level of abstractness. It is instantaneously "referred" to the proper category and identified according to as many dimensions as are applicable. When I hear the "Ode to Joy" I "subsume" it under, say, four other categories, "Music," "Choral Work with Symphonic Orchestra," "Beethoven," and "Last Part of Beethoven's Ninth Symphony." Each of these categories is "lower" than the one before it; each one is less inclusive.

If I hear Japanese koto music for the first time, my perceptual analyzers begin filtering the sound along some parallel "testing" dimensions. I identify it as "Music," "Non-Western," "Stringed Instrument," "Woodwind Accompaniment," but beyond those gross differentiations, I may register only unknowns or incongruities. If my curiosity is sufficiently aroused, I may search for more information. "What does it look like?" or "How is it played?"

If new information is an "extension, modification, elaboration or qualification"[19] of something I already know, and at basically the same level of abstraction,

then "correlative subsumption" is said to take place. For example, when I learn that the United States has six per cent of the world's population and about half the world's resources but an income distribution that shows 77% of total income going to the top half of the population and 23% going to the lower half,[20] I have added a statistical unit of understanding to my knowledge about the inequality of resource distribution in the world.

New knowledge takes on a "superordinate" organizing quality if it gives me a more inclusive view, under which I may now group heretofore unrelated facts. I learn, for example, that "No Exit" and "Waiting for Godot" are both "existentialist" plays, or that a number of monarchs ruling pre-World War I European nations were all relatives of Queen Victoria.

The use of symbols or names gives stability to the cognitive structures we possess. When we "associate" or "relate," we see a new connection. It may be "horizontal," as when I connect "femininity" with "servility," or "vertical," when I see how many female secretaries there are in the business offices of the world, and file it under "Underutilization." The connection may be causal, when I understand that schools encourage stereotyped behavior in boys and girls. The connection may be

evaluative, when I relate my perceptions to a standard or ideal, and conclude that exploitation is an unsatisfactory state of affairs. When we make these kinds of dynamic connections, we are in fact analyzing things--taking them apart in order to understand their causes and effects, relating them horizontally or vertically to other useful frames of reference. This mode of examination differs from the more static naming, defining, describing, differentiating mode, which must usually precede the relating mode.

There is a third mode of examination, which involves an integrating or synthesizing of static and dynamic parts into a new whole. We use this mode when we draw conclusions, reformulate theories, plan for the future, or create new realities. This mode will be discussed in a subsequent chapter.

If concepts and connections become stabilized, they take on a kind of structure. My way of thinking about women is likely to be different as a result of the new connections I have made. No matter what the topic is, the entire background is activated as a unit, and even though I may not be consciously aware of it, any more than I am conscious of the grammatic codes that I use to govern my speaking, the activated structure helps me to select and organize my thinking and acting.

Coded organizers such as "Music," "Inequality," "Existentialist Plays," or "Underutilization" are useful because they are connected with structures--interrelated concepts, facts, and propositions--which exist outside of the individual, as well as inside his brain. The word "Music" is more inclusive than "Works by Beethoven." If I am learning about music, I will be aided by less inclusive coded organizers. They may be time-based (Medieval, Baroque, Romantic, Contemporary), or people-based (Bach, Brahms, Bacharach), value-based (The Greatest Piano Concerto, The Most Moving Mass), competence-based (Elementary Pieces for the French Horn), memory-based (The Music We Heard On Our Honeymoon, The Madrigals Mom Can Remember), etc.

If I am evaluating the learning that a student has done, I can use coded organizers which help me test what is reported against criteria. The code, however, may be too inclusive, too general. I may be asking "How is he demonstrating growth?" Or I may be looking for examples of an overly narrow coded criterion--"How well is he applying the writings of Max Weber?" Or I may choose several organizers that give me a focus, but which allow the student to demonstrate learning in his own way. For example, in reviewing the learning done by a University Without Walls student who worked as a VISTA volunteer, Dr. Clark used four appropriately inclusive organizers as criteria:

(1) sensitivity to the environment, (2) awareness of differences, (3) use of facts and theories, and (4) evidence of personal growth.[21] Coded organizers such as these help us to make relevant discriminations and meaningful connections.

Synthesis

Let us once more re-organize our outline.

I. Knowledge and Competence

A. Increased ability to respond involves the development of structures which examine the input in more discriminating ways, and organize responses in more efficient ways (Ch. III).

1. The organism becomes more attuned to the environment by learning to recognize new patterns. This involves testing, matching, and modifying (Ch. II).

2. Digital-to-analogue conversions are efficient and can be hierarchially organized (Ch. II).

II. Processes Connected with Gaining Knowledge

A. We use different modes of examination to acquire knowledge.

1. Data-gathering Mode (Static Clarification)

a. Selectivity

(1) The organism exercises selectivity according to its own criteria of relevance (Ch. III).

b. Differentiation

(1) Neurological information is coded into discrete units (Ch. II).

(2) Sensory input is "broken up" or differentiated by sensory receptors (Ch. III).

(3) The ability to make finer discriminations increases our effectiveness at responding to the environment (Ch. IV).

c. Patterning

(1) Discrete units (impulses) are combined and integrated (Ch. II).

(2) Parts are combined or patterned by perceptual organizers (Ch. III).

(3) The learning of symbols involves abstracting the essential pattern (Ch. IV).

2. Analytical Mode (Dynamic Relating)

a. Connecting (relating data to causes, effects, values, themes, structures, experiences, etc.)

b. Modifying (changing the meaning)

III. Factors which Facilitate Gaining Knowledge

A. Engagement

1. The organism must be "aroused" before information can be transmitted (Ch. II).

2. When stimuli become relevant, we tend to engage ourselves more readily in examining them (Ch. IV).

B. Competence

1. The organism must be competent to receive various types of input before it can process that input (Ch. II).

2. We are more competent at examining stimuli which are natural and familiar (Ch. IV).

C. Use of Coded Organizers

1. The conscious use of coded organizers facilitates meaningful examination and reporting (Ch. III).

2. Coded organizers are effective when they are connected with a useful structure, and appropriately inclusive (not too concrete, not too abstract) (Ch. IV).

Footnotes to Chapter IV

[1]Koestler, The Act of Creation, p. 537.

[2]Saltz, The Cognitive Bases of Human Behavior, pp. 28-32.

[3]Koestler, The Act of Creation, p. 537.

[4]p. 207 #7.

[5]Ausubel, Educational Psychology, p. 43.

[6]p. 90 #14.

[7]Ibid., p. 563.

[8]Ibid., p. 563-564.

[9]D. P. Ausubel, Educational Psychology: A Cognitive View (New York: Holt, Rinehart and Winston, 1968), p. 42.

[10]J. McV. Hunt, Intelligence and Experience (New York: Ronald Press, 1961), pp. 114-115, cited in Munn, The Evolution and Growth of Human Behavior, p. 417.

[11]B. S. Bloom, Taxonomy (Cognitive) (New York, David McKay Co. 1956), p. 144.

[12]Koestler, The Act of Creation, p. 642.

[13]Ibid., p. 642.

[14]M. H. Abrams, ed., The Norton Anthology of English Literature Vol. I (New York: W. W. Norton, 1962), p. 76.

[15]Webster's Dictionary, p. 1447.

[16]Ibid., p. 1447.

[17]Ausubel, Educational Psychology, p. 131.

[18]Ibid., p. 128.

[19]Ibid., p. 52.

[20]"Tick, Tick, Tick," The New Republic, (May 29, 1971) p. 6, cited in J. Harrington, The Rhetoric of Film (New York: Holt, Rinehart and Winston, 1973), p. 21.

[21]Review Committee meeting for Crediting Prior Learning for Rosemary Hulsing, April 30, 1973.

C H A P T E R V

CODING AND SKILL-BUILDING

This chapter focuses on competence rather than knowledge. Competence was defined as the ability to perform a coordinated set of behaviors in order to accomplish a goal. It is "patterned" activity. It is not random movement. It attempts to "do" something that the performer envisions in his mind.

In this chapter we will draw on metaphors from physiology and on the theories of Arthur Koestler. We see that viewing skill-building as a hierarchic build-up of coded action patterns is more plausible than the S-R hypothesis that behaviors are "chained together" through reinforcement and conditioning. This does not deny that practice and reward are unimportant. But if competence consisted of irreversible connections between receptors and muscles, people would have no flexibility, no power to create new forms. The pianist could play only in one key, since his fingers would be rigidly connected to certain notes, not guided instead by the pattern of the melody, which transcends individual notes. The athlete would have no freedom to modify his strategy according to instantaneous feedback. Writers and speakers would have trouble substituting one theme for another.

The major premises in this chapter are:

(1) Patterns of activity are governed by codes.

(2) Patterns of activity are hierarchically organized.

(3) Competence involves combining simpler acts into complex ones.

(4) Lower level skills become increasingly automatic.

(5) Non-specific catalysts can activate patterns of activity.

(6) Feedback facilitates movement toward a goal.

(7) Practice increases competence.

Patterns of activity are governed by codes.

Koestler believes that habits, skills, abilities and even coherent thinking processes are governed by an implicit code of fixed rules. These codes lend order and variety-in-unity to all levels of organic life, from the division of cells to the instinctive behavior of animals to the complex symbolizing processes in the human brain.

In animals, biologically relevant codes are built in through genetic organization. For example:

> The common spider will suspend its web on three, four, and up to twelve handy points of attachment, depending on the lie of the land, but the radial threads will always

> intersect the laterals at equal angles, according to a fixed code of rules built in to the spider's nervous system; and the centre of the web will always be at its centre of gravity. The matrix--the web-building skill- is flexible: it can be adapted to environmental conditions; but the rules of the code must be observed and set a limit to flexibility.[1]

Koestler clarifies what he means by "code."

> [The word] code . . . signifies on the one hand a set of rules which must be obeyed--like the Highway Code or the Penal Code; and it operates in the nervous system through 'coded signals'--like the Morse alphabet--which transmit orders in a kind of compressed 'secret language'. We know that not only the nervous system but all controls in the organism operate in this fashion (starting with the fertilized egg, whose 'genetic code' contains the blueprint of the future individual. But the blueprint in the cell nucleus does not show the microscopic image of a little man; it is 'coded' in a kind of four-letter alphabet, where each letter is represented by a different type of chemical molecule in a long chain).[2]

The molecule is DNA (dioxyribonucleic acid), and the four letter alphabet is A, G, C and T (adenine, guanine, cytosine, and thymine). These four nitrogenous bases are always linked in pairs--A always with T, G always with C--to the rungs of the double helix "ladder." In 1953 Watson and Crick were able to decipher this code, showing how these four bases could govern the production of proteins and enzymes.

How could four letters be arranged to form at least twenty different "words" (twenty amino acids)?

If bases were paired, then 16 "words" could be formed (4 X 4 = 16). If bases were combined into triplets, 64 words would be possible (4 X 4 X 4 = 64). Evidence now indicates that the bases are indeed linked into three-letter "syllables," but that several different syllables or codons may specify the same amino acid. For instance, CGA, CGG, CGT and CGC all specify the same amino acid, alanine. Some codons perform the function of punctuation marks, designating the beginnings and endings of genes in the long DNA chain.[3]

While we will not go into the process of protein synthesis, we will note that great differentiation can be achieved through the organization and interrelationship of only four starting units, and that the synthesizing of the proliferating chemicals, which leads to cell division, requires a breaking apart (of the DNA threads) and a connecting or assembling (transfer RNA attaching appropriate acids to the nascent protein chain), according to coded instructions (messenger RNA chemically structured with a "recipe" from the DNA molecule itself).

Codes determine the patterned growth of the embryo. The cells divide through mitosis, in which the chromosomes separate into identical threads, each cell maintaining a whole blueprint for guidance. As the cells increase, they become differentiated into three layers. The outer

layer (ectoderm) is programmed to become the sense organs and nervous system; the intermediate layer (mesoderm) will become the skeletal, muscular and circulatory systems; the inner layer (endoderm) will turn into vital organs and glands. While the code is operating from the cell nucleus, bringing about changes in the cytoplasm through operators and repressors, the importance of intercellular conditions increases. Mechanical pressures from surrounding cells that make up its immediate environment begin to take part in regulating development. In other words, the effect of feedback becomes crucial. Sub-codes in the blueprint apparently "switch off" when certain stages are reached.

We must now differentiate between "code" and "matrix." The code is the fixed, invariant, "analogue" pattern or set of rules. The matrix is the ensemble of part-processes, moves, or "digital" connotations which derive from the organizing code. The code is fixed and automatic. The matrix is the adaptable, more explicit side of the unconscious unitary process. The twenty-letter alphabet of protein synthesis is more explicit than the three-letter alphabet of the genetic code; it "spells out" what the latter implied. Similarly, the first movement of a sonata spells out melodically the implications of a coded organizer--theme, development,

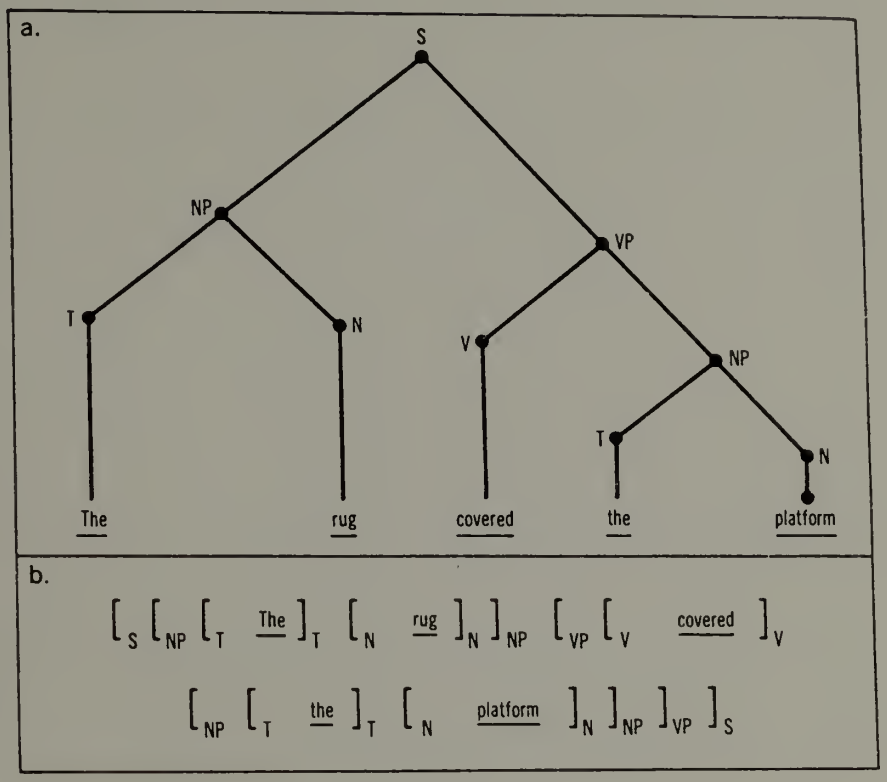
recapitulation. The code functions on a trigger-release principle, but the resulting action pattern varies according to strategy, environment and the will or creativity of the player or actor.

Simple examples of explicit codes on the verbal level are commands like "name opposites," "translate into German," "list cities beginning with the letter M," "multiply," etc. Motor codes might include anything from "build a house" to "make the bed." Each contains a hierarchy of plans which, assuming we have had some experience, will be activated in the right order, but with some flexibility. The resulting action patterns constitute the "matrices" of the directing code.

Aside from highlighting the pervasiveness and efficiency of coding operations within the organism, the twin notions of codes and matrices illuminate the means by which organisms learn to change and control their behavior.

Once a pattern or process becomes ingrained in the nervous system, it functions automatically, without conscious effort. For example, in speaking, we structure our sentences according to complex grammatical and syntactical rules, but it would be extremely inefficient to consciously determine a phrase-marker before stating an idea. Nevertheless, every sentence is a manifestation of coded rules, and linguists have developed ways to represent the

structure of sentences. "The rug covered the table" could be diagrammed as either a hierarchy or a linear bracketing.[4]



Label: Figure 6. Two ways of Phrase-Marking a Sentence.

The ability of organisms to "code" patterns and use them effortlessly to organize behavior is of tremendous importance! Progress in evolution is achieved through the development of more and more complex and specialized body structures, and through more elaborate ways of coordinating their function. This principle must also apply to information-processing and learning. Codes

have evolved because they are efficient coordinators. Organized hierarchically, they can activate "chunks" of behavior, patterns of visual, auditory and verbal organization, plus symbolic processes which are crucial to learning.

Patterns of activity are hierarchically organized.

When "higher" organs develop in the embryo, a measure of control is handed over to them. These take over a more dominant coordinating function and constitute higher levels in the internal hierarchy.

> It appears that certain regions of the organism exert dominance over cells in other regions. The central nervous system, which is first evidenced as a groove, dominates even remote parts of the organism. The head end, especially, serves as an 'organizing center' and it has a marked influence upon cellular development. Indeed there appears to be a hierarchy of such centers with the head exerting the greatest dominance.[5]

Thus parts in the embryo become sub-wholes. Facing upward in the hierarchy, organs behave as dependent parts which are inhibited or triggered by higher controls. But each "sub" is also a "whole" and therefore manifests autonomy and spontaneity, according to its own codes. Cells function as power plants, growing and reproducing. Muscles respond selectively to general excitations, determining such distinctive patterns as a person's handwriting, gestures and gait. The heart is regulated by its own

autonomous pace-maker, but it still submits to the control of hormones and the autonomic nervous system, which in turn are affected by higher centers in the brain. Autonomous mechanisms in perceptual processes form visual constancies and filter the input as their cellular structures dictate, but attitude, expectation and planned concentration also exercise control. Lastly, Koestler believes that "thinking and communicating are based on hierarchically ordered, autonomous patterns of enunciation, grammar, logic, mathematical operations, universes of discourse."[6] Can we assume that undergraduates could also function with a great deal of autonomy if their own learning "codes" could be engaged, or must we continue to believe that learning on one's own is a second-rate, unreliable experience?

A statement by Paul Weiss highlights "the relative autonomy of structured patterns of activity, and the hierarchical principle of their organization."[7] It also clarifies the role of the higher echelons in terms of a more efficient delegation of authority.

> The nervous system is not one big monotomic pool whose elements can be freely recombined in any number of groupings, thereby giving an infinite variety of nervous responses. This used to be the old idea of the associationists, and it is utterly incompatible with what we have learned about the development of the nervous system and its function in animals.

> The working of the central nervous system is a hierarchic affair in which functions at the higher level do not deal directly with the ultimate structural units, such as neurons or motor units, but operate by activating lower patterns that have their own relatively autonomous structural unity. The same is true for the sensory input which . . . operates by affecting, distorting, and somehow modifying the pre-existing, preformed patterns of excitation, which are in no way replicas of the input. The structure of the input does not produce the structure of the output, but merely modifies intrinsic nervous activities that have a structural organization of their own.[8]
>
> (italics mine)

We see a good reason for this hierarchical organization. For the brain to direct the functions of every cell group would be as inefficient as a general issuing orders to every soldier in the army, rather than sending a general order to the squadron leaders, who can then carry out the details according to strategy and conditions in the immediate environment. If a generalized signal can activate local, pre-set responses, which can function autonomously because of their internalized codes, just as non-specific inducers can catalyze the progressively differentiating embryo, much energy can then be freed to carry on more complicated or abstract thought.

Competence involves combining simpler acts into complex ones.

How are new codes and matrices learned? The answer

seems to be that relatively simple codes, if they are clearly differentiated, are integrated into more complex ones, organized hierarchically. Elementary skills, which can be learned through stamping-in, trial and error, and practice become unified into a single pattern, which can be activated then as a unit. Skills like typing and piano-playing are good examples.

In typing, the student first learns the location of every letter, through practice. Eventually he forms "word-habits" and "phrase-habits." Single letters are no longer thought about, since he has learned the coordinated group of movements that produce the word. He no longer needs to look at the keys, once their location becomes familiar.

Almost any finger can be used on the piano keys, unlike the typewriter, which requires that certain keys must always be struck by certain fingers. By practicing the scales, the student learns the relationship between notes and sounds, and accustoms the muscles in his hands to move in certain ways. Eventually the left learns to accompany the right, acting as a pace-maker. Visual input is coded. The music score symbols designate tempo, melody and mood, as well as which hand shall play which stave. The score must be rapidly decoded and recoded, without thinking, when a player performs. Phrases

of a piece are learned and integrated, until the whole can be played as a unit, without the music. At the highest level, the computations become so automatic that a pianist can use his brain and his ear to improvise and create new forms. An athlete who has learned the basic routines can trigger them in a split-second. His mind is freed to concentrate on meaning."[9]

Lower level skills become increasingly automatic.

As the hierarchy is built up, the lower-level motions become almost reflex. A typist instructed to type "teh" whenever "the" appears in a manuscript will have great difficulty changing that automatized word habit. Skills can also become rigid habits when they operate in a monotonous environment. The stickleback fish is rigidly "programmed" to survive in his environment. The units in his instinctual hierarchy have become almost entirely automatized. Fixed action-patterns are triggered as a unit by specific environmental cues. Tinbergen's studies have shown, for example, that the fish's "migrating" code is triggered by the lengthening of days. Water temperature, green vegetation, etc. trigger the "nest-building" code, the activities of which are broken down into "digging," "testing of materials," "glueing," etc.. Fighting, mating and caring for offspring are also subdived into automatic operations.[10] The lower level skills, however, are less

flexible than the higher coordinating levels. This can be seen as a general principle: degrees of freedom increase with each step upward in the hierarchy. More alternatives are available; more decisions are possible. But which one will be chosen depends on strategy and environment.

The fact that grammatic, syntactic and semantic rules have become ingrained allows the individual thinker to use his energy to concentrate on ideas. Preparing to say something is to set a hierarchy in motion. In preparing a lecture, for example, it is efficient to list the major ideas or themes. These are like analogue organizers. They can then be ordered according to a controlling idea or point of view, and spelled out into explicit sentences according to strategy, purpose and anticipated feedback (audience reaction). The subcodes of grammar are automatized as are the fixed patterns of the clichés and familiar phrases that we use frequently in communication.

Non-specific catalysts can activate patterns of activity.

The fact that codes are internalized--pre-set for complex and autonomous action patterns--enables them to be set in motion by a relatively non-specific catalyst. At the zygote level, the simple trigger-releaser is the impact of a fertilizing agent. Normal development of

the egg can be induced by heat, cold, salinity, ultra-violet rays, even puncture with a needle, in addition to the male's sperm. "Though it may be hurtful to the male's pride," says Koestler, "his seed seems to be a dispensible commodity. Its primary function is to trigger off the egg; but--with frogs at least--a platinum needle will do just as well."[11]

Once the cell groups have reached a state of readiness, determined by the degree of differentiation within the embryo, a chemical releaser sends the tissues into the next autonomous stage of development. The catalyst can again be non-specific. For example, rudimentary nervous systems can be induced to develop in salamander embryos by such unrelated things as salt solutions, organs of mice and insects, or tissues from adult organisms.[12] However, the reacting tissue must be "competent" or ready to receive this carefully-timed catalyst. Tissue which has been launched toward becoming a head cannot be re-programmed to become a tail.[13] Pribram and others use this readiness concept to assert that central states in the brain must be ready to provide the context before stimuli can be understood.[14]

The concept of non-specific catalyst is a very useful one. Technically, a catalyst is any substance which causes or speeds up a chemical reaction. Using

this as a metaphor, we can redefine "catalyst" as any action which engages the learner in effectively examining and reporting new information. A catalyst energizes a response. Questions or requests may therefore be good catalysts. So are conflicts, issues or problems that the learner is interested in exploring or resolving. So are novel situations or proposed tasks which intrigue him.

When combined with coded organizers, catalyzing questions can facilitate examination and reporting. When consciously or intuitively combined with good coded organizers, catalyzing questions can help the learner "get a handle on" an experience which initially looks chaotic. The following interchange illustrates how guiding ideas can be introduced to an examination process. Although they are suggested by the sponsor, they must be "operationalized" by the student, who can then expand them or illustrate them based on his or her own language and criteria of relevance.

The interchange took place between a University Without Walls student (Kay), her faculty sponsor (Tom) and myself. In this case the student was interested in arranging credit for past experience. We can assume that the sponsor was already familiar with the specific dates, location, organization, job responsibilities and other background material which provide the context for examining Kay's experience in community development.

Tom: In order to get credit for your participation in this community development project, you have to show that learning took place.

Kay: I know that I learned to do a lot of things. It's just a question of how to write them up.

Tom: Think in terms of a theoretical definition of a 'community', or competencies that you developed, or what motivated you, or how you grew, or what principles you saw operating in the community.

[Here Tom suggests five fairly non-specific organizers which can be 'coded' as Definitions, Competencies, Motivations, Aspects of Personal Growth, and Operating Principles. These should be easily relatable to Kay's experience, but it will be confusing to talk about all five at once, and we are not sure that she can translate them into useful modes of examination.]

Linda: Tom, could you pick one of those and work with some examples?

Tom: Let's take two 'headings': theoretical definition and competence. Using a sociological context, we could define a 'community' as an association of people brought together by a common cause.

Kay: In this case it was fear that brought the people together...

[Kay goes into an explanation of this. She begins to describe the fear and to talk about its causes and effects, structuring an exposition around her own feelings and perceptions. This is a good example of a broad focus triggering a whole presentation, almost as if it were a structured set of associations, activated as a unit. However, we want to eventually redirect her back to the other heading that Tom suggested, and to clarify the organizers so that she can select the best ones and develop them in writing.]

Linda: Taking the other heading, Kay, could you name a kind of competence that you gained?

Kay: Well, the most basic one was learning how to handle people.

Immediately we have a new focus which Kay herself has abstracted, but we're not clear on what she means. The source of ambiguity is the verb.

Linda: Can you tell us what you mean by 'handle'?

Kay: Well, I mean getting people to do what you or the boss want them to do.

Now we can move to differentiate between the kinds of people involved, the goals of the leaders, and the various means of managing people in an institution. [15]

Let us ask what might have happened if Tom had asked Kay to specify the competencies she acquired in Organizational Development or Systems Management? Would it have been as puzzling (and threatening) as the sound of a gong to Pavlov's dog? The terms are parts of an academic structure which is highly codified, and yet Kay learned "how to handle people" without the help of management theory. By asking her what kinds of skills she learned, Tom provided an appropriate, non-threatening and fairly non-specific catalyst. This enabled Kay's own valueing and selecting inclinations to designate a "whole" theme area, and she could have examined her growth either as a progression from basic administrative

skills to high-level policy-making, or as an increased understanding of motivational and managerial principles.

Adults have developed individualized and complex cognitive structures. When a person communicates a point of view or a question or an interest, the words are representatives of internalized "schemata" (to use Bartlett's term) as well as parts of a dynamic process. Every sentence says something and does something. The counselor must "decode" both content and process, testing the speaker's clarity, matching the substantive content against his own knowledge, and directing the conversation according to a distinct set of principles. The counselor aims to elicit and clarify the learner's interests, learning style, language and value system, and to activate the selecting, abstracting, relating and integrating processes that began in our heads as children. Of primary importance are the purposes that the student has for himself.

Feedback facilitates movement toward a goal.

Returning to a physiological frame of reference, we see that feedback is another crucial determinant of activity within the body.

Each cell and organ has an environment. The chemicals, nutrients, wastes and temperature are continually in a state of flux, yet a constancy must be maintained through carefully coordinated physiological reactions.

The lungs take in oxygen and eliminate carbon dioxide; the liver adds or subtracts organic molecules as needed; the kidneys dispose of the right amount of wastes, water and salt. The resulting equilibrium is known as "homeostasis." Virtually every activity of the body contributes to the maintenance of stability.[16] To achieve the goal of maintaining stability, cells and organs must have feedback from their environments.

The body also receives feedback from various environments. Koestler illustrates the connection between feedback and hierarchical organization.

> The environment of John driving his car is the traffic stream around him. The environment of John's right foot is the brake-pedal on which it rests. Let us call the former an environment on the t-level, where t stands for the top of the hierarchy controlling the various sensory, motor and cognitive processes which constitute skill in driving; then the brake-pedal will be an environment on the, say, t minus 4 level. Now John approaches a sign which reads "Halt--Road Works Ahead". This input is analyzed and relayed by various stations on the perceptual and cognitive hierarchy, and is eventually recoded into a 'sign-releaser' which triggers off the pre-set patterns of slow-down-to-a-halt behavior on the lower echelons of the motor hierarchy. . . . This consists of several sub-skills: braking, steadying the wheel, going into neutral gear at the proper moment.
>
> . . . We may perhaps speculate that the digitally coded signals: 'brake', 'steady wheel' have been converted into analogue-computing servomechanisms. But speculations

> apart, we can confidently say that an action-pattern of a general nature has been initiated on the top level, and that the details were successively filled in by feedbacks from more and more restricted local environments on the lower echelons. Similarly, the future adult is 'roughed in' in a summary way, in the morphogenic gradients of the zygote.
>
> The performance of a skill means executing a general order by a series of progressively differentiated action patterns, each controlled from above, and adjusted by local feedbacks.[17]
>
> (italics mine)

In learning a complex new skill, feedback from an expert can be a great help. However, the expert has internalized an entire hierarchy. To be effective he must be able to shift from the whole to the parts, and back again. He must show the learner how to fuse the separate motions into a coordinated performance. Miller, Galanter and Pribram use the experience of learning to fly an airplane as a good example.

> There is a kind of complementarity between the teacher and the student. It is easy for the teacher to describe the general strategy, but difficult for him to communicate the detailed tactics that should be used. For the student, on the other hand, each of the muscular moves can be made in isolation, but it is difficult for him to combine those tactical details into a larger mechanism that will effortlessly guide his movements to reduce the differences between his intended and his actual performance. In order to be able to execute the Plan by a smooth, controlled motor unit, the aspiring aviator must find many small, intercalated acts not specified in the instructor's original description of the plan.[18]
>
> (italics mine)

To acquire competence, the learner must continually test the results of his actions, and make adjustments accordingly. A person who can give the learner accurate and objective feedback about his progress can help him direct his energy more efficiently toward the goal.

Practice increases competence.

This premise is self-evident, for the most part. Yet when it comes to becoming competent at active learning, many educators seem to feel that listening to lectures, rather than learning by doing, increases growth.

Arthur Chickering has asked what actions can be taken by colleges to increase the contribution made to student development. His survey of research and theory led him to make three recommendations: first, increase the emphasis on intellectual competence by "taking students through the processes by which we generate our lectures instead of sparing them those labors by delivering the product ourselves."[19]

Secondly, increase direct experience (". . . higher education is still hooked on books."[20]). Thirdly, increase flexibility:

> Curricular changes--increased emphasis on intellectual competence, increased direct experiences, and increased flexibility--will be enhanced if teachers shift from soloist to conductor. The teacher's job is to help students create the music, not to make all the music himself. He does

> his best by them to perform, by helping individuals contribute effectively, and by coordinating individuals and groups so that the totality has form and substance. The consequent shift for students is from passive to active.[21]

The question then arises: how can a facilitator become a conductor rather than a soloist? How can he engage the student and communicate clearly, while allowing the learner to experiment and develop his own style? This question becomes much more complicated when we shift our attention from motor learning to conceptual knowledge. It is much easier to develop plans for teaching concrete skills. The goals are clear, progress is measureable, feedback is more easily given, and the student can actually look at models.

We can perhaps begin to answer this by outlining what is meant by skill-development, and asserting that practice and feedback move the learner toward more and more advanced levels of competence.

Receiving Basic Instruction
- -receiving instruction
- -observing demonstrations
- -understanding how the parts go together to form a whole

Beginning Skill Development
- -planning action
- -first attempts
- -making adjustments according to feedback

Intermediate Skill Development
- -improvement through practice

Advanced Skill Development
- -achieving mastery
- -professionalism

-increasing effectiveness and independence
-increasing variety and flexibility

-teaching others
-creating new forms

Synthesis (abbreviated)

I. Knowledge and Competence

A. Increased ability to respond involves the development of structures which examine the input in more discriminating ways, and organize responses in more efficient ways (Ch. III).

1. The organism becomes more attuned to the environment by learning to recognize new patterns. This involves testing, matching, and modifying (Ch. II).

2. Digital-to-analogue conversions are efficient and can be hierarchically organized (Ch. II).

II. Processes Connected With Gaining Knowledge

A. We use different modes of examination to acquire knowledge (Ch. IV).

1. Data-gathering mode (Static Clarification)

a. Selectivity

b. Differentiation

c. Patterning

2. Analytical Mode (Dynamic Relating)

a. Connecting (relating data to causes, effects, values, themes, structures, experiences, etc.)

b. Modifying (changing the meaning)

III. Processes Connected With Gaining Competence

A. Patterns of activity are governed by codes (Ch. V).

B. Patterns of activity are hierarchically organized (Ch. V).

C. Competence involves combining simpler acts into complex ones (Ch. V).

D. Lower level skills become increasingly automatic.

1. Receiving basic instruction
2. Beginning skill development
3. Intermediate skill development
4. Advanced skill development

IV. Factors Which Facilitate Gaining Knowledge and Competence

A. Engagement

B. Competence

C. Use of Coded Organizers

D. Non-specific catalysts can activate patterns of activity (Ch. V).

E. Feedback facilitates movement toward a goal (Ch. V).

F. Practice increases competence (Ch. V).

Footnotes to Chapter V

[1]Koestler, The Act of Creation, p. 38

[2]Ibid., p. 40.

[3]Vander Sherman, and Luciano, Human Physiology, pp. 97-103.

[4]Neisser, Cognitive Psychology, p. 256.

[5]Munn, The Evolution and Growth of Human Behavior, p. 37.

[6]Koestler, The Act of Creation, p. 468.

[7]Ibid., p. 434.

[8]P. Weiss, ex tempore contribution to a discussion at the Hixon symposium, cited in L. A. Jeffress, ed., Cerebral Mechanisms in Behavior--The Hixon Symposium, (New York: Wylie, 1951), in Koestler, The Act of Creation, p. 434.

[9]Ibid., p. 550.

[10]N. Tinbergen, The Study of Instinct (Oxford: Clarendon Press, 1951), pp. 478-480.

[11]Koestler, The Act of Creation, p. 418.

[12]Ibid., pp. 419-428.

[13]Pribram, Languages of the Brain, p. 261.

[14]Ibid., p. 262.

[15]Interview between Kay Mielke, Tom Clark, and Linda Reisser, Fall, 1972.

[16]Vander, Sherman, and Luciano, Human Physiology, p. 161.

[17]Koestler, The Act of Creation, pp. 469-470.

[18]Miller, Galanter, and Pribram, Plans and the Structure of Behavior, p. 83.

[19]Chickering, Education and Identity, p. 324.

[20]Ibid., p. 325.

[21]Ibid., p. 328.

C H A P T E R VI

THE SYNTHESIZING MODE

We have implied that it is easier to establish a picture of how competence is built than it is to conceptualize the acquisition of knowledge. We will therefore return to an examination of cognitive learning.

We wish to do two things in this chapter. One is to complete part II of our outline (Processes Connected With Gaining Knowledge) by delineating a third mode of examination--the "synthesizing" or "creative integration" mode, as indicated by the types of questions asked by entering freshmen. The other is to analyze the questions and relate them to a knowledge-based continuum. The continuum is an arrangement of the three modes of examination and their component part-processes.

The Synthesizing Mode

We have observed that differentiation and integration lie at the heart of all organic growth. Analysis and synthesis are parallel processes which underlie cognitive learning. Let us look at the concept of "synthesis" more closely.

Bloom defines synthesis as:

> The putting together of elements and parts so as to form a whole. This involves the process of working with pieces, parts,

> elements, etc., and arranging and combining them in such a way as to constitute a pattern or structure not seen before.
> . . . . . .
>
> Comprehension, application, and analysis also involve the putting together of elements and the construction of meanings, but these tend to be more partial and less complete than synthesis in the magnitude of the task.[1]

Bloom gives three examples of end products which represent synthesizing: (1) a unique communication (which proposes to inform, describe, persuade, impress, or entertain): (2) a plan or proposed set of operations (e.g. plan for an experiment, plan for a new teaching unit); (3) a set of abstract relations (deductions, hypotheses).[2] He is speaking in terms of an entire product, for example, a student's final paper, as a synthesis.

We wish to differentiate between "synthesis" as a complete product, and "synthesizing" as a mode of examination. The essence of this mode is "seeing a new picture," just as it is for Bloom. It differs from clarifying static realities (naming and describing what "is") and from making dynamic connections (explaining "why"). When a learner is synthesizing, he is reorganizing, integrating, concluding and predicting. It is a creative process in that the results are "new" to him. He looks at his "data" (observations) and analyses (relationships) and asks "therefore, what?" What is the conclusion? What can we predict? He must integrate what he has seen in order to see something

new and fairly complete.

Why not adopt Bloom's Taxonomy of Educational Objectives (Cognitive) as a picture of the basic processes involved in learning? Bloom gathered and ordered educational objectives that classroom teachers used, ranked them in order of complexity and gave sample test items for each. Bloom pioneered a great deal of clarity with his taxonomy, but he derived his six categories (Knowledge, Comprehension, Application, Analysis, Synthesis, Evaluation) by listening to what teachers wanted to teach rather than what students wanted to learn. The three modes of examination in this thesis were deduced as a result of looking at the kinds of questions that college students asked, and the kinds of reporting that self-directed students attempted. The sample is small, but the patterns tell us a great deal.

Three Kinds of Questions

During the summer of 1972, I had the opportunity to meet with small groups of freshmen Education majors. In trying to get them to clarify their goals, I tried three different approaches. The first two will be discussed later. The third method was strikingly more successful than the other two.

I worked with five groups of students, eight in each group. I asked them to (1) make a list of the

interest areas that they wanted to explore while studying at the university; (2) select the most important one(s); (3) translate each area into a question that they would like to answer. I recorded their answers. The results were as follows:

Child Development

(1) What are the effects of social problems on children?

(2) What is normal vs. abnormal physical growth as well as psychological development?

Special Education

(3) How do you bridge the gap between people who are not alike?

(4) How do you bring disadvantaged people up to their potential?

Psychology

(5) Why do people react the way they do?

Psychology

(6) Would all the major problems in the world be solved if we could understand each other better?

(7) Are all people basically alike?

History

(8) How does the past affect today?

(9) How can we explain what's happening today?

Physical Education

(10) Do we put enough emphasis on exercise?

English

(11) How does the literature of the past answer today's questions (personal and social)?

Psychology

(12) What causes emotional disturbances?

(13) Why do people turn to crime?

American Government

(14) Does it now represent the people?

Education

(15) What are the stages in a child's thinking?

(16) What makes kids better able to get along with each other?

Anthropology

(17) How has man evolved?

Psychology

(18) What makes people normal?

(19) What are the effects of family, religion and society?

Special Education

(20) How can you spot a child who needs help?

(21) Can early correction be accomplished?

Theater Arts

(22) Can you learn to be more sensitive to others through the theatrical experience?

(23) Where does the 'front' stop and the 'real' begin, on stage as well as in society?

Psychology

(24) How can we improve our self-concepts?

(25) Where is the line between genius and insanity?

Education

(26) Is a self-directed approach more effective than traditional classroom methods?

History

(27) What is the history of the Asian countries?

Literature

(28) What books have had the greatest impact on their own societies?

Archaeology

(29) How is it used as a tool of history?

(30) How are the skills acquired?

Geology

(31) What has caused the formation of physical features on the earth's crust?

Political Science

(32) How can political theory be used to explain historical change?

Geography

(33) How does it relate to history?

Psychology

(34) How does the mind function?

(35) What is deviancy?

(36) What makes people overreact?

Poetry

(37) Can free verse express ideas better than patterned rhyme and meter?

Fiction

(38) How have themes and styles changed over the centuries?

Art

(39) How can I make things that I visualize in my mind?

Home Economics

(40) How can you manage a household?

Linguistics

(41) How did languages develop?

(42) How do they differ?

Psychology

(43) Why do we do the things we do?

(44) What runs our mind?

Sports

(45) Why are they satisfying?

Sewing

(46) How do I make a coat?

Psychology

(47) Is it possible to understand and predict the actions of the mind?

Philosophy

(48) How do I form an insight into life?

Literature

(49) Are thoughts reflected most clearly through writing?

Nature

(50) In what ways does the environment control human beings?

Politics

(51) How are modern politics controlled?

(52) How are people controlled by a government?

Art

(53) What is art? How did it originate?

Music

(54) Why does music affect people the way it does?

Ancient History

(55) What are the causes of important events in ancient times?

Literature

(56) What makes the classics great?

These questions fall into three patterns: (1) "intransitive" questions. These asked about the nature of some subject, or about how two subjects compared to each other. They asked "What is it?" or "How does it differ from . . .?" of "Where did it come from?" They revolve around intransitive verbs. Answers to these questions would require reporting in terms of descriptions,

definitions (synonyms, parts, examples, functions, origins) or comparisons.

Intransitive Questions

(2) What is normal vs. abnormal physical growth as well as psychological development?

(7) Are all people basically alike?

(15) What are the stages in a child's thinking?

(17) How has man evolved?

(23) Where does the 'front' stop and the 'real' begin, on stage as well as in society?

(25) Where is the line between genius and insanity?

(27) What is the history of the Asian Countries?

(29) How is [archaeology] used as a tool of history?

(33) How does the mind function?

(34) What is deviancy?

(37) How have themes and styles changed over the centuries?

(40) How did language develop?

(41) How do [languages] differ?

(52) What is art? How did it originate?

(2) "Transitive" questions. These contain or imply both a subject and a direct object. They revolve around a transitive verb, that is, a word which denotes a dynamic relationship. The action "carries over" from subject to

object. The questions ask about how one thing affects or has affected another. The answers would require explanations of cause and effect, connections between theory and fact, translations, evaluations, and in general, any connection that modifies or augments the meaning of the data.

Transitive Questions

(1) What are the effects of social problems on children? [How do social problems affect children?]

(5) Why do people react the way they do? [What things cause people to act?]

(8) How does the past affect today?

(12) What causes emotional disturbance?

(13) Why do people turn to crime?

(14) Does [the American government] now represent the people?

(16) What [things] make kids better able to get along with each other?

(18) What [things] make people normal?

(19) What are the effects of family, religion and society on people?

(28) What books have had the greatest impact on their own societies?

(30) How are [archaeological] skills acquired?

(31) What [forces] have caused the formation of physical features on the earth's crust?

(33) How does [geography] relate to history?

(36) What [things] make people overreact?

(43) Why do we do the things we do?

(44) What runs our minds?

(45) Why are [sports] satisfying to people?

(50) In what ways does the environment control human beings?

(51) How are modern politics controlled?

(52) How are people controlled by a government?

(54) Why does music affect people the way it does?

(55) What [things] are the causes of important events in ancient times?

(56) What [things] make the classics great?

(Evaluative Questions)

(10) Do we put enough emphasis on exercise?

(26) Is a self-directed approach more effective than traditional classroom methods?

(49) Are thoughts reflected most clearly through writing?

(3) "Subjunctive" questions.

The term "subjunctive" is a member of another class of syntactic indicators, that is, the "mood" of the verb. In English there are three moods: the indicative, the imperative and the subjunctive.

> Mood = mode = modus (in Latin)--hence a way of doing, saying or being something; but the word is influenced by Mood: temper, a state of mind, from the Old English 'mod', heart, mind. The moods of verbs express states of mind. They express 'the manner in which the

> action or state of being it denotes is conceived, whether as a fact, or as a matter of supposition, desire, intention, possibility, etc.' (Webster's)[3]

The indicative mood deals with facts, whereas the subjunctive deals with things entertained as thoughts, desires or possibilities.

"Subjunctive" questions ask "How can (might) something be done?" or "Could (would) something happen if . . . ?" The answers would require a synthesis of basic data, assumptions about cause and effect, and extending theories. They ask for conclusions, predictions, and integrations. They deal with change, new knowledge, or new interpretations.

Subjunctive Questions

(3) How do you bridge the gap between people who are not alike?

(4) How do you bring disadvantaged people up to their potential?

(6) Would all the major problems of the world be solved if we could understand each other better?

(9) How can we explain what's happening today?

(11) How [can] the literature of the past explain today's problems?

(20) How can you spot a child who needs help?

(21) Can early correction be accomplished?

(22) Can you learn to be more sensitive to others through the theatrical experience?

(24) How can we improve our self-concepts?

(32) How can political theory be used to explain historical change?

(37) Can free verse express ideas better than patterned rhyme and meter?

(39) How can I make things that I visualize in my mind?

(45) How do I make a coat?

(40) How can you manage a household?

(47) Is it possible to understand or predict the actions of the mind?

(48) How do I form an insight into life?

These three types of questions are simpler versions of the kinds of inquiry which are familiar to graduate students and faculty who have earned the right to do self-directed learning in the form of research. We can identify three types of research:[4]

(1) historical/descriptive studies, such as case studies, surveys, and comparisons; they examine "what has been" and "what currently is";

(2) analytical/interpretive studies, which ask how two or more things relate to each other, usually in terms of cause and effect;

(3) experimental research, which tries to systematically propose and test hypotheses about "what would happen if . . . ?"

For undergraduates and adults unfamiliar with formal modes of inquiry, the highly codified guidelines

for rigorous data-gathering, analysis and synthesis are unknown. However, it seems possible to adapt the essential patterns of organization to the interests that have relevance for them. Furthermore, it seems likely that these modes of examination, on a simplified level, are extensions of the processes we have been exploring throughout this paper. They seem clearer, more appropriate, and more useful than Bloom's. Students can see the connections between questions and modes of examination, and so they can more easily orient themselves about what needs to be done in order to "get the answer."

Two Other Goal-Specification Methods

The "question-asking" method was the third type of catalyst that I used last summer. I resorted to it because the other two logical methods produced only vague results--goal statements that did not inform them about actual courses of action, as the questions did.

I will review the results of a "goal-listing" method and a "course-design" method to show how I concluded that these were not effective ways to facilitate self-directed learning.

Group I consisted of eight women--all freshmen. After an initial introduction and exchange of names, I stated an interest in how they would formulate goals for themselves as undergraduates. I asked them to take five

minutes to think about the kinds of things they wanted to accomplish during their years at the University, and to make a brief list of their important goals. After five minutes of thinking and writing, I asked them whether they would enjoy sharing what they had written, and whether they would mind if I took notes about what they said. They agreed that this would be fine, and I tried to note accurately how each list was reported.

1. General knowledge in many subject areas
   Knowledge of many types of people through interaction
   Plans for a career
   Knowing where I stand on various issues
   More skill at decision-making

2. To learn my potential scholastic skill
   To meet and understand different people
   To become more of an individual through meeting people and finding more interests
   To learn for the pleasure of learning
   To acquire professional skills
   To become an independent working unit
   To expand

3. To do well in classes
   To gain a knowledge of options open to me
   To understand problems in Education

4. To become more learned in various subjects
   To learn to speak French more competently
   (I'm not so concerned with a job right now)

5. Preparation for indepencent accomplishments
   To be competent
   To follow up varying interests
   To gain practical experience

6. To find out my potential
   To take courses that are more challenging
   To study a variety of fields and then specialize
   To learn about people and their attitudes

7. To be competent in one field (French)
   To take subjects not taken before
   To get a satisfying job
   To find the answer to 'what's the best way to teach?'

8. To go into a variety of subjects in greater depth
   To learn different methods of teaching
   To be more independent
   To meet more and different types of people
   To be more qualified

I then made the following statement:

> I see three major areas of goals that you've listed--academic goals (subject matter implied), competence goals (professional) and personal goals (growth in independence, knowledge of different people). Since you're making decisions today about academic courses, I'd like you to think about goals regarding knowledge in subject areas and to see how specifically you can break your general goals into specific courses of action.

After another five minutes of thinking and writing, they shared the following lists:

1. To take voice lessons (Can I do that as an Ed. major?
   To be in plays and musicals
   To study literature from different periods
   To study biology--to learn the origin of man
   To study the family and society ('Why?') I'm an only child, so I'm curious about my own family and how the family is changing today

2. To study what others have thought about (life, death, the universe)
   To learn about groups and why they are different
   To learn about growth and living processes

3. I hate math and I'm not interested in science
   I love to read. I want to know about psychology and philosophy and why children act the way they do
   I love photography. Small children make great subjects.

4. To go into English literature in depth, in addition to French

5. I have a curiosity about the principles of how things work, especially natural sciences--botany, geology, astronomy.
   Art and music. I'm the only one in the family who missed piano lessons.

6. I hate math and love reading. I want to find out what the author's attitudes are.
   To study psychology and sociology to find out why people operate the way they do
   Other cultures
   The life processes--botany and biology

7. I hate science and math but a lot of that was due to the teachers I had. I want to start over again and learn math correctly.
   Ecology
   Psychology
   Existentialist literature
   To learn to speak well

8. I want to know how man has developed, historically and physically.

This time there was more extensive and spontaneous elaboration on their interests, both from the "presentor" and from others in the group. When asked how they felt about the hour-long session, they seemed to agree about two points,

(1) it made the institution seem more "personal" than it had been; prior to this discussion they had been tested and addressed as a large group, so this was apparently a welcome change;

(2) hearing each other's goals made them feel more comfortable (e.g. "While I was writing, I was worried about putting down the wrong sorts of things. It was good to find out that everyone's in the same boat.").

In other words, the feedback related to the worth of small group sharing rather than to the meaningfulness of listing goals. Repeating this approach with three more groups produced very similar results. My conclusions were:

(1) the general goals were very abstract and did not indicate many concrete directions for actual learning projects;

(2) the general goals fell into three groups: knowledge, competence and personal growth;

(3) in the general goal statements there was a preponderance of infinitive phrases that implied general "states of becoming" rather than specific actions (e.g. "to become more learned in various subjects" rather than "to study literature from different periods.");

(4) while the more specific subject matter goals contained more action words, they did not convey an awareness of different aspects of the actual learning process; they revolved around "learning" and "studying" in general, rather than around applying, evaluating or analyzing;

(5) the more specific goals tended to relate to traditional academic areas;

(6) the request for a breakdown of general into more specific goals prompted a statement about likes and dislikes from many ("hating" math or "loving" reading);

(7) the more specific goals did not seem to connect as directly to the more general goals as they did to concrete past experiences ("I'm the only one in the family who missed piano lessons" rather than "I want to study music because an educated person should be able to appreciate it.");

(8) the general goals were stated in a rather detached manner and directed at me; the more specific goals were stated with more spontaneity and feeling, and this apparently caused more reactions from others in the group; the information flow became more of a mutual exchange.

I began to wonder whether freshmen could specify their goals more clearly if they were asked to design a course. I knew that almost all of the freshmen would preregister for Elementary Psychology. Group IV consisted of only five students. After initial introductions, I asked them to try an experiment.

> It's your first day in Psychology 101. I'm the professor. Do you know what Psychology is?

(They respond: 'The study of the mind', 'the study of individuals', 'the study of behavior and what motivates it'.)

OK. What I'd like each of you to do is to help me design this course. I want it to be relevant to your goals, so take ten minutes and jot down some suggestions. I need to know what you'd like to get out of this introductory course, what questions you'd like to explore, and what projects would help you meet your goals. Be as specific as you can about what the course should be like.

They seemed to have considerable difficulty with this.

Each person reported rather hesitantly.

1. It would have to be a general course that introduces the subject. It should define the terms and show the types of categories that psychology covers. It should be a small class with a lot of discussion. The professor should get to know the students. It should go into more depth than high school courses in psychology.

2. It should be general at first, then branch into more specific problems. It should study people's actual beliefs and interactions rather than relying too much on a textbook.

3. I don't know. I guess it would be good to start with how psychology began. The field is pretty unknown to me really, so I'd want a good overview from the professor and a lot of small group discussion.

4. I would like it to be a general course with a small number of students. I like to learn by observing examples of something so I would hope for a lot of demonstration.

5. We had a psychology class in high school, and did a lot with instincts, emotions and conditioning. We studied people in different situations, like when they met

> strangers would they tend to be dominant or submissive? I would want to go on studying how people change or stay the same when conditions around them are changing.

I summarized my perceptions for them and they generally agreed that:

(1) it was fairly hard to design a course, although if we were to work longer as a team, we would probably be able to do it. Between the various suggestions they hit upon the need to study the history of a field, to define the terms and to explore the sub-areas;

(2) the girl who had had some experience with psychology in high school found it easier to name more specific areas of study;

(3) as a group they seemed to value a small class, a lot of discussion, and studying real people or real problems, and that the course should begin generally and get more specific.

I tried the "course design" approach with two more groups and got similar results. Asking students to work in pairs and triads didn't seem to help. They tended to focus on what the class size should be and what the professor's role should be, rather than what they wanted to actually learn or what kinds of projects would be appealing.

The Usefulness of the "Question-asking" Approach

The "goal-listing" and "course-design" methods of goal-specification produced vague results. Why? When we arrange our three modes of examination along a continuum, we see that some steps are simpler and more basic than others.

Knowledge-Based Continuum

Exam. mode	Data-gathering	Analysis	Synthesis
	Select (name) Differentiate Pattern (group or categorize)	Connect (values, causes, themes, structures, experiences, etc.) Modify	Reorganize Integrate Conclude Predict

To state a future goal or to design an entire course requires a synthesis. Statements were vague because there was no foundation for the synthesis, nothing upon which to base a logical reorganization of data. By asking students to select current interests, based on past experience or current choice, and translate those into questions, the static interest areas were energized--given direction. Many successful learning contracts state goals in terms of answering specific questions, and this is much clearer than aiming at "gaining knowledge" or "increasing understanding."

Furthermore, questions are excellent analogue organizers. Their components may be broken down into more

concrete parts, enabling the learner to focus more clearly on what he wants to know. For example, question two on our list asked "What is abnormal vs. normal physical growth?" This is an intransitive question. Underneath the main concept, growth, we listed more specific indicators on the blackboard: size, weight, coordination, speaking, eating, socializing, etc. By selecting a target age group, the questioner could reformulate a clearer starting question: "How do experts in child development define normal physical growth for children from age one through five? Do they use the indicators we've listed, or are there others?"

Question one was a transitive question, and therefore a more difficult question: "How do social problems affect children?" We listed possible sub-areas underneath the subject and object.

How do social problems affect children?

-racial difficulties	1 - 4 yrs. old
-environmental crisis	4 - 14 yrs. old
-recessions	14-18 yrs. old
-drug problems	boys / girls
-urban crowding	rich / poor

The questioner narrowed the focus area by selecting the four-to-fourteen age group. By looking at each alternative (more specific) "social problem," she could reformulate better questions, more direction-oriented engagers:

Do racial difficulties cause children to
feel more or less prejudice?
To think about the meaning of color?
To act more disruptively in school?

Does urban crowding force children into
criminal behavior?

Do drug education programs have any real
effect?

Are children aware of a tight economy?

Will the next generation save the environment?

The group that examined this question quickly saw that in order to answer these more specific cause/effect questions, they would need more basic data (e.g. "What do we mean by 'racial difficulties"?').

Question 4 is a very vague, theoretical question, but the group easily transformed it into the beginnings of an interesting study. Again, we broke down the subject and object into various alternatives.

Would all problems be solved if we could
understand each other better?
Rephrased: Could we solve our problems
through better understanding?

we	problems
Arabs / Jews	warfare
WASPS / Chicanoes	discrimination
Rapists / victims	assault

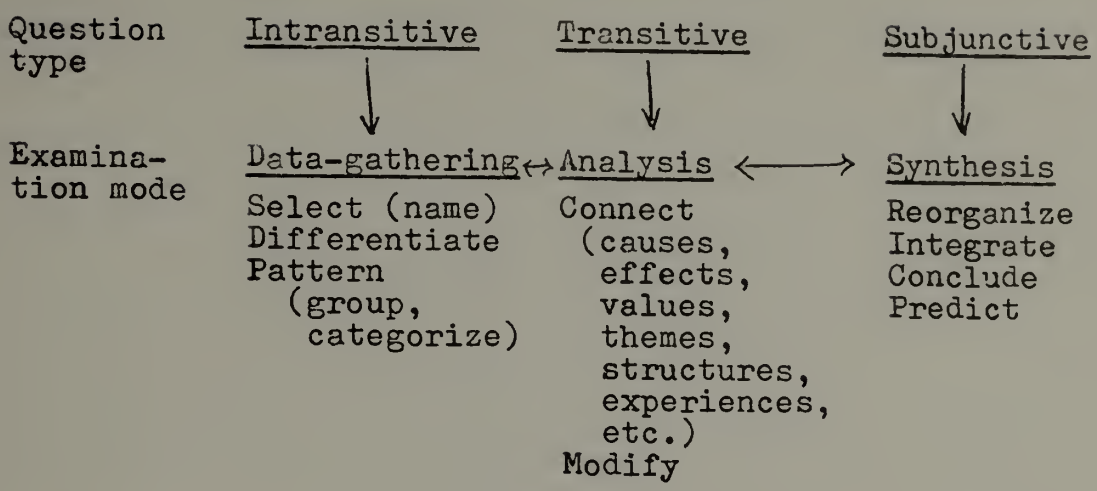
The questioner selected the first sub-area. I asked her to translate the interest into more specific questions and arrange them in a logical order. She responded: "What is the current situation in the Middle East? Why are the

Arabs and Jews at the brink of war? Is it realistic to expect that peace can be assured through understanding or negotiation? Are there alternatives? An all-out war? Deterrence through military strength?"

In this last instance, the question began as a hypothetical statement. It was structured as an "If . . . then what?" question. In order to clarify it and make it more manageable, she transformed it by adding two types of foundation-laying questions. One asked for a description of "what is." The second asked for the causes of the situation.

In summary, the questions relate directly to the examination modes. They indicate the types of processes that the learner will need to use. They also imply ways to "ground" the inquiry by supplementing analytical examination with definitions and descriptive data, and ways to extend it by moving toward integrations and conclusions.

Knowledge-Based Continuum



Synthesis (abbreviated)

I. Knowledge and Competence

A. Increased ability to respond involves the development of structures which examine the input in more discriminating ways, and organize responses in more efficient ways (Ch. III).

1. The organism becomes more attuned to the environment by learning to recognize new patterns. This involves testing, matching, and modifying (Ch. II).

2. Digital-to-analogue conversions are efficient and can be hierarchically organized (Ch. II).

II. Processes Connected with Gaining Knowledge

A. We use different modes of examination to acquire knowledge. (Ch. IV).

1. Data-Gathering Mode (Static Clarification)

a. Selectivity

b. Differentiation

c. Patterning

2. Analytical Mode (Dynamic Relating)

a. Connecting (relating data to causes, effects, values, themes, structures, experiences, etc.)

b. Modifying (changing the meaning)

3. Synthesizing Mode (Creative Integration)

a. Reorganizing

b. Integrating

c. Concluding

d. Predicting

III. Processes Connected with Gaining Competence

A. Patterns of activity are governed by codes (Ch. V).

B. Patterns of activity are hierarchically organized (Ch. V).

C. Competence involves combining simpler acts into complex ones (Ch. V).

D. Lower level skills become increasingly automatic (Ch. V).

1. Receiving basic instruction

2. Beginning skill development

3. Intermediate skill development

4. Advanced skill development

IV. Factors Which Facilitate Gaining Knowledge and Competence

A. Engagement

B. Competence

C. Use of Coded Organizers

D. Non-specific catalysts can activate patterns of activity (Ch. V).

E. Feedback facilitates movement toward a goal (Ch. V).

F. Practice increases competence (Ch. V).

Footnotes to Chapter VI

[1]Bloom, Taxonomy of Educational Objectives (Cognitive), p. 162.

[2]Ibid., pp. 163-164.

[3]E. Partridge, English: A Course for Human Beings (4th ed.; New York: Books for Libraries Press, 1949), p. 65.

[4]J. W. Best, Research in Education (2d ed.; New York: Prentice-Hall, 1970).

CHAPTER VII

BLUEPRINTING AND ONGOING PROJECT SUPPORT

The idea of a facilitation process implies that one person helps another. Learning how to learn is enhanced by communication and sharing. Initial interests can be transformed into satisfying learning projects through directed dialogue. A skillful, empathetic counselor can do things that bring students to an awareness of their own self-directing capabilities. It is important to emphasize the interpersonal dynamics involved in this process. Without people to use it, a learning theory is an abstruse set of assertions. While a theory can be used to program a teaching machine or a do-it-yourself manual, it cannot create the spark of excitement between student and sponsor when they embark upon a shared quest for knowledge.

What can human facilitators do that manuals and machines cannot?

Facilitators can explore the individual background and learning style of each student. College-age adults have been through an extensive schooling process, and a thorough socialization process. They have learned to behave toward authorities in certain ways, to adopt roles, to perform according to acceptable norms. Some of these habits can help them to be self-directed, and others will

obstruct them. For example, many students who negotiate contracts are eager to have the sponsor state what is expected, what constitutes successful performance. A manual cannot work to reverse this habit as gently and consistently as a person can. Other students articulate ideas that have always intrigued them, but feel that a personalized exploration is not entirely respectable, since no matching course exists. A machine cannot affirm this impulse to strike out alone.

Secondly, a facilitator can ask questions that increase awareness and learning competence. Every student's proposed project is different, as is the language he uses to talk about it. Yet the basic processes involved in examining and reporting seem to be built in to the human nervous system. They need only be "triggered" by good catalysts, and pointed out by sensitive listeners. Most students can describe something, can explain causes or effects, and can draw conclusions, if only they are requested to do so.

Thirdly, a counselor can provide ongoing support and feedback. The chance to share new experiences with a skilled listener seems to be important to students who are essentially testing themselves. But the facilitator must establish credibility by showing that he can give constructive criticism as well as illuminating feedback and sincere appreciation. In other words, he must show

that he has mastered the art of examining what the student says, and reporting his reactions in a supportive manner. For the student, learning to know and believe in one's capabilities is as important as learning to specify goals and write papers.

So, a facilitation process, with its underlying theory of learning, is simply a way to keep track of a series of verbal and written transactions. It includes both the planning of a project and the ongoing examination of progress. Steps in the process are tools in the counselor's repertoire, but they do not supersede the ability to listen and react, the mutual enjoyment of exploration, the art of inducing a productive conversation.

The Learning Process

A facilitation process should be congruent with a useful picture of learning. Let us summarize the picture as it has emerged in this thesis.

A person engaged in learning is essentially "questioning" the environment in three major ways. First, he is clarifying a picture of some aspect of his world. He asks, intuitively, "What am I selecting as an area of interest? What questions do I have? What patterns do I see? By answering these kinds of questions, he gathers basic data, and begins to fill in the gaps in his knowledge.

Secondly, he adds meaning to what he sees by looking at the causes and effects, and/or by relating explicit data to less obvious facts and concepts. He asks, "Why did these things come about? How can I use these perceptions? What other ideas change the meaning of my initial observations?" He increases his understanding by interrelating things. He connects his perceptions with personal values and experiences.

Thirdly, he creates a new picture. He combines static patterns and dynamic relationships to build a new "structure"--a new arrangement of facts and ideas. Hopefully, this new synthesis informs him about what to do in the future, what could be done that was not obvious beforehand, how knowledge can be applied in order to increase the effectiveness of his response to the world. He asks, "What are my conclusions? What can I predict? What can I create?"

These three modes of examination are extensions of information-processing principles that seem to operate in neurological, sensory-perceptual, and conceptual systems. Humans learn to respond more effectively to the people, objects and events around them by using selective perception, differentiation, forming patterns or abstract concepts, seeing relationships, and reorganizing information into new knowledge.

New competencies are built by first observing others and receiving instruction; secondly, by planning and attempting to perform, and making adjustments in the light of feedback; thirdly, by improving through practice, growing more flexible and independent; and fourthly, by achieving high levels of efficiency and creativity and the ability to teach others. Simple acts are combined into more complex ones. As subskills are practiced, they become more automatic, so that generalized intentions can trigger a whole series of action patterns.

Factors which also facilitate learning include engagement (arousal of interest), competence to deal with new information, the use of coded (conceptual) organizers, non-specific catalysts (open-ended questions), feedback, and practice.

The Blueprinting Process

How can this theoretical picture of learning be combined with an interpersonal facilitation process? We can first outline a congruent scheme for planning self-directed learning projects. We can then discuss conditions that facilitate ongoing self-directed learning in terms of actual counselor behavior.

Blueprinting is a process which facilitates the planning of a self-directed learning project. Each step can be accomplished in a variety of ways, according to

the style of the facilitator. The overt purpose is to help the student clarify his plans in such a way that he can specify them on a contract. Implicit goals are to give the student some practice at using modes of examination, and to help him become aware of the intellectual skills involved in self-directed learning.

Through questioning, reflecting, and suggesting, the facilitator attempts to help the student

(1) select an area of interest;

(2) clarify it through differentiating it from other areas, and/or specifying its relevant sub-parts;

(3) organize the parts into meaningful patterns;

(4) translate the patterns into "engagers" (questions, issues, tasks, etc.)--goal-oriented statements that clearly imply a beginning point, a sense of direction, and an ending point;

(5) synthesize a goal statement;

(6) plan activities which aim at accomplishing goals;

(7) plan ways to evaluate progress.

We will attempt to clarify the rationale for each of these steps.

Select an area of interest.

By naming an area and separating it from other related subjects, the learner can concentrate his energy. He learns to exercise choice. Just as perceptual processes "screen out" most of the stimuli that reach the sensory receptors, probably in order to minimize interference with goal-oriented thought, the naming of an interest area enables a student to screen out other lines of inquiry that would fragment his energy.

Clarify it through differentiating it from other areas and/or specifying its sub-parts.

For example, a student who selects an interest area like "education of the blind" may want to specify that this does not include such related areas as "recreation for the blind," or "visual learning theory." This differentiation among areas serves to sharpen the focus.

By listing sub-parts of an area, a student can generate a range of more specific alternatives without having to synthesize an entire statement of a problem. This is a sort of free association which makes explicit the conceptual connections, the more concrete and manageable derivatives of an organizing category. For example, when asked "What kinds of things do you want to look at?" the student easily listed sub-areas associated with blind education:"what it's like to be blind, how many

blind people there are, what different schools for the blind are like, what teaching methods are used, how well I can work with the blind, what training I need, etc." By asking a student to clarify what they mean, the counselor asks him to try out his defining and describing skills, working from general levels to more and more varied and specific ones.

Organize the parts into meaningful patterns.

The listing of sub-areas can be a lengthy process, just as the reporting of observations or experiences in a journal can be an exhausting data-collecting exercise. Organizing lists of data according to common elements or major themes can make many details more manageable. This is like the process of forming discrete elements (matrices) into analogue patterns (codes). If I visit fifty colleges, they may eventually be blurred and forgotten. However, if I group those fifty visits under categories (private vs. public, small vs. large, urban vs. rural), I can remember and analyze them more easily. The student intersted in blind education could group a large number of concerns under four headings: (1) the nature of blindness, (2) the effects of schools on blind students, (3) the effects of social attitudes on blind students, and (4) conclusions about what should be done, by schools and by concerned

individuals. These areas represent a range of inquiry which moves from static to causal to hypothetical modes of examination.

Translate the patterns into "engagers."

By transforming sub-areas into questions, issues, or tasks, static interests are made dynamic. They are energized with a sense of forward direction. A starting point and an ending point can be identified. When the questions are answered, when the issues are resolved, when the tasks are accomplished, then the project reaches closure. It does not continue aimlessly. "To study the nature of blindness" as a goal statement does not inform the learner about how to direct an examination. However, a "blueprint" is clearly implied when we list questions like "What is the legal definition of blindness? Are there various degrees of blindness? What do people with varying sight actually see? How do other senses compensate?" We can sense where to begin and where we will end.

Questions are also curiosity-provokers. Issues create suspense. We wonder which side will win, or which system is better. Engagers which challenge the imagination are more likely to sustain interest than a rather vague intent to "study something" or to "gain experience."

Synthesize a goal statement.

Engagers can be ordered and expanded to form a

fairly complete plan. Yet the actual structure will look different from the blueprint, just as the behavioral matrices of a coded intention will very according to strategy and environment. Plans must be somewhat general and flexible enough to be changed in midstream.

Goal statements are easily constructed by placing specific questions, tasks, or problems in a context. They should summarize and formalize the commitment to complete a project, recording the overall purpose for later reference.

To see the relationship between specific tasks and overall purposes, to relate questions to an engaging theme, to visualize a complete project instead of a foggy predilection is to experience the rewards of the human ability to integrate and create. College students may have written many papers or performed many skills, but they may not consciously have identified these integrations as a synthesizing mode of behavior. To do so is to become more aware of the problems and processes involved.

Plan activities which aim at accomplishing goals.

Many students come in with initial ideas about what they want to do. The challenge is to get them to clarify why they want to do it and what they want to learn. Once the goals are clear, activities can be planned which relate logically to them. For many students, the experience

of finding resources, internship sites, or relevant books is entirely new. In the process of searching and negotiating, they learn to rely on their own resources, and to clarify agreements in writing.

The student interested in blind education concisely stated her planned activities, although it certainly did not reflect the amount of legwork that she did, nor did it spell out the explicit connections between the plans and the goals. However, for contract purposes, it suffices:

> (1) Once a week I will be working with an itinerant teacher for the blind, through the Springfield School System.
>
> (2) Once a week I will be traveling with the Supervisor of Education for the Blind. He will take me to rehabilitation centers to see how the blind train for jobs.[1]

Plans can be expanded to include varied but complementary activities, according to the imagination and inclination of student and facilitator, and according to how much previous experience the student has had. For example, a student who initially wanted to start a library in a residence hall complex had an interest in library science, but no experience with traditional libraries or relevant readings. It was logical to augment his creative enterprise with some foundation-laying activities. His contract eventually read:

Statement of Objectives

To acquire, understand, and utilize information pertaining to the study of Library Science. Basic information would include (1) history of libraries and their usage; (2) varieties of libraries that exist today; (3) library systems of the world; (4) current usages of libraries; (5) planned use of libraries for tomorrow.

Planned Activities

(1) 15 hours per week working at Goodell Library so I can become part of the system, understand the inner mechanisms of organization and have access to resources;

(2) 10 to 15 hours per week working at the Southwest Library. I hope to be the principal architect in the creation of this;

(3) 10 to 15 hours per week of independent research into the literature of the field, overseen by Sam Markson (a Director of Goodell Library).2

Our conceptual scheme suggested that creative endeavors represent the most challenging mode of learning, and this implies that some knowledge of "what others have done" and "how new ideas can be related to traditional practices" be integrated as foundations for creativity.

Plan ways to evaluate progress.

Learning is dependent upon feedback. Evaluation is a kind of feedback, a more formal means of assessing growth. A discussion of learning skills and modes of inquiry can be a helpful way to suggest criteria to the student. Measurements of success might center on how well

the experience is described or how carefully the working concepts are defined, how well theory is related to practice, or how clearly causes and effects are discerned, how well experiences are structured in a final paper in order to indicate conclusions, etc. If the project is competence-based, then the student may want to specify tasks connected with progressing from beginning skill development to intermediate.

It has been my experience that many students about to embark upon a project have made good use of outlines like the knowledge- and competence-based continua. However, it behooves the facilitator to first elicit the student's thoughts on evaluation criteria, supplying suggestions only if he runs into difficulty. If students are aware of the processes they use to assimilate knowledge and organize papers, they they already have some operational control over what they're doing. The facilitator can help him refine this awareness. Since colleges tend to teach content and not process, this type of student is probably very rare.

Facilitation Factors

Engagement

What do we mean by "engagement"? The term is really a refined version of "arousal." A student is

engaged when he is interested, curious, fascinated, inspired, and involved. Engagement also implies "connection." When the learner and the facilitator are working together, connecting well, then they are mutually interested in an area of inquiry. Engagement facilitates learning not only because physiologically it seems to activate information-processing in the cerebral cortex, but also because it insures a sense of excitement, significance, shared adventure. It reduces the self-doubt and fear that may accompany first attempts at independent work.

How does a facilitator engage the student in self-directed learning? How does he get him to engage himself? Primarily, the facilitator must activate his own learning and communicating skills. He asks for basic data--what the student's background is, what he wants to do, how he got the idea, what he knows about the area. He listens actively--concentrating, reacting, translating or rephrasing what the student says. He begins to relate the student's ideas to a systematic planning process. He generates alternatives, summarizes patterns, gives feedback about what the student appears to be doing. He states his own preferences and points of view when appropriate.

But above and beyond the eliciting of content and the activation of processes, it is the emotional connection

that assures engagement. By manifesting interest and enthusiasm, the facilitator demonstrates a willingness to share in the excitement, and to contribute the use of his own intellectual and human relations skills to support the self-directed endeavor. He aims at increasing the student's anticipation for trying his own strengths. Engagement involves creating an atmosphere of acceptance, participation, and exhilaration.

Competence

We have noted that people must be competent to deal with new information before they can make it meaningful, just as sensory-perceptual and other cellular systems must reach a state of readiness before normal growth can proceed. How can a facilitation process help students to assess their competence at dealing with the challenges of self-directed learning?

Perhaps the most obvious way is to discuss his activities throughout the semester in terms of the growth of competence. Groundwork for this can be done by exploring the extent of a student's familiarity with the area of interest. This is an examination of knowledge already possessed. If a field is totally new, then the need to use data-gathering skills becomes apparent. If the student is convinced that he understands basic facts,

principles, and theories, then he can feel secure about tackling more complex questions.

What if the facilitator is basically unfamiliar with the student's area of interest? Should he refer the learner to an expert? In some cases, yes, if an expert is available. However, the learner's ability to judge his own competence is paramount. If a student can reasonably justify that he is able to create music or teach history or study cybernetics, then why not encourage him to attempt it? The challenge, then, is to establish valid ways to measure success and to exercise self-criticism.

Just as a student may not be aware of how much he already knows, he may not know how he feels about attempting a new mode of learning. This too can be clarified by drawing the student out--asking him to verbalize his feelings and understand the reasons for them.

We wish to facilitate not only competence at dealing with content, but also readiness to deal with process--an ability to consciously analyze, and to follow through in writing. One way to help a learner assess how well he can independently examine and report is to request an initial piece of writing--a proposal for a project or a contract draft or an early progress report. Requests for writing activate the synthesizing of descriptions and plans. Together, student and facilitator can then review

the patterns and problems revealed on paper. If the student finds that he has difficulty writing and reviewing his initial work, this may be an indication that he is not comfortable with the responsibilities, and should be encouraged to work without seeking academic credit.

The use of coded organizers

These are useful concepts, organizing themes, or ideational structures which guide examination and reporting. By consciously using a formula, a facilitator can more easily direct the conversation. He can locate the course of a project-planning session by referring to an internalized picture of the Blueprinting process. Knowing the essential goal of each step, he can structure specific requests and reactions according to the quality of interaction. Knowing the skills involved in examination and reporting, he can activate them in the learner. Knowing the need for a contract, he can move from generating alternatives to bringing about closure, using the contract headings as organizers. Without a set of guidelines, a facilitator is like a conductor without a music score, and random sounds are likely to result.

A facilitator also needs to identify the organizers that a student wants to use. These can be elicited and named when the interest area is broken down into parts, and clarified when the goal statement is formulated. For

example, types of organizers are underlined in the following goal statement:

> Statement of Objectives
>
> I am interested in observing the communication-interaction process in two elementary classrooms of the same age groupings. These classrooms will be in two different schools. I feel this will give me a basis for comparison. I will be looking for different types of interaction and the frequency of occurrence (i.e., interaction between pupil and teacher, between pupils and teacher, and between pupils and pupils.)
>
> From the data I collect, I hope to determine what role the teacher plays in the classroom. For example, is she an authoritarian figure momopolizing much of the verbal exchange? Is she a facilitator of student-to-student communication? How often is she an observer or guide? Does she instruct more than encourage self-discovery? Is the atmosphere she creates a tense or relaxing one? What is her relationship to her students and how does that influence peer interaction?
>
> The last question shifts away from objective data-gathering to an analysis of relationships.
>
> I plan to keep in mind the importance that physical factors play in a learning situation (e.g. room organization and temperature). I will look for special centers set aside for individual work and for the display of the children's work. I will note the weather as well as the freedom of mobility.[3]

As periodic reports are made, these organizing concepts can be invoked, clarified, or changed. Using them, the counselor can structure the examination process so that randomness is avoided, and continuity of focus is

maintained. The student must be allowed to modify his original plans, based on feedback from the specific learning environment.

Non-specific catalysts

These are open-ended questions that allow the student to use his own terminology, selectivity, and creativity. Whereas a believer in Bloom's Taxonomy might ask a student to identify the trends, conventions, and methodology within a field of study, a self-directed learning facilitator can simply ask the student for a description of what he wants to do and how he wants to do it.

Since codes are assumed to govern individual thinking and speaking, non-specific questions can activate the reporting of relevant observations. The knowledge-based continuum suggests excellent non-specific catalysts. For example:

(Select)	"What kinds of things are you most interested in?" "Do some incidents stand out more than others?"
(Describe)	"What have you been doing?" "How did you first decide to try that approach?"
(Define)	"Could you give an example?"
(Translate)	"When you say _____, what do you mean?"
(Explain)	"Can you tell me why you chose one approach over another?"

(Relate)	"Are your actions reflecting values?"
(Evaluate)	"What's been the best and the worst part of this experience?"
(Conclude)	"What are the most important things that you learned?"
(Apply)	"Could you train me to do what you learned to do, only better?"

Feedback

There are three kinds of feedback that the facilitator needs to deal with. The first two are personalized verbal or written responses--objective feedback and critical feedback. The third relates to the feedback perceived by the learner while he is working in the field.

While engaging the student in initial and ongoing conversation, a good counselor periodically "feeds back" what is said. He rephrases important messages with objectivity and sensitivity. This does two things: (1) checks against misinterpretation, and (2) demonstrates the counselor's interest in what the student is saying.

Critical feedback entails an analysis of merits and faults. It means expressing appreciation as well as constructive criticism about how the student seems to be falling short of his own goals. It is the facilitator's responsibility not only to give feedback, but also to get the student to appreciate and criticize himself, and to respond effectively to the reactions of others.

Thirdly, it is likely that plans and goals will have to be adjusted according to the demands of reality. Unanticipated problems and opportunities must be taken into account, just as continuous testing and modifying goes on inside the human body, as it maintains its stability against the changes in the environment. As the self-directed project goes onward, students should be made aware of their responsibility to renegotiate the contract as necessary. To recognize the need for changes is a positive thing, although many students feel embarrassed that they didn't anticipate every exigency. By encouraging communication and reasonable changes in the original blueprint, the facilitator can encourage accountability and openness to feedback.

Practice

Practice enables the student to grow more sure of himself, less concerned with basic skills and details, and more adept at effectively activating goal-oriented responses. This is especially true when self-directed learning involves skill-building--learning to make films, master creative dance, advise parolees of their rights, etc.

It is also important to acquaint learners with the ways in which they replicate the processes that professional educators and researchers use to structure information. By pointing out how the student grows more effective

at observing, analyzing, questioning, and reporting, the facilitator reaffirms the ways in which commitment and effort pay off. This assumes that students who contract to do self-directed learning will sustain the effort and continue to report on their progress.

What can be done when they fail to report in? What happens when they have difficulty directing their progress, or lose enthusiasm for systematic examination? This is why the contract is important. Terms of the agreement must be clear enough to justify academic credit, and to provide implicit guidelines for terminating the engagement. In many cases a phone call will remind the student that a progress report is overdue. Progress reports are a good way to stimulate practice with the modes of examination. However, without a regular class meeting to provide the impetus for regular work, students can inadvertently flounder. If the facilitator judges that the student is not responding to clear requests for more consistence and communication, then he has the right to cancel the contract.

When a counselor can help a student to become aware of his power to learn, confident in his ability to take risks, united with others who are on the same kind of journey, then he is acting as an educator in the best sense of the word. The Latin verb "educere" means "to

draw out" or "to lead from." In universities, it too often means "to talk at." Rather than dispensing knowledge, a facilitator educates by drawing out the student's interests, feelings, hopes, and insights, and leads him to turn his present level of knowledge and competence into a map for future discovery.

In the next chapter, we will address the problem of how to assess that learning has taken place. In a classroom setting, it is relatively easy to come up with measures of progress. Projects and examinations are the academic's touchstones. But the self-directed learner pursues knowledge outside the classroom, with no one else to whom he can compare his performance. He becomes the structurer of information, and the examiner of his own progress. Therefore, those who represent the university, those who "legitimize" this learning through the granting of credit, must find ways to identify evidence of learning. The next chapter will suggest that the reports submitted by self-directed learners can be excellent indicators of progress if we develop a conceptual framework for interpretation.

Footnotes to Chapter VII

[1]B. Weinberg, "CADRE Self-Directed Learning Contract," Sept., 1972.

[2]S. Arakelow, "CADRE Self-Directed Learning Contract," Feb. 15, 1973.

[3]S. Elliot, "CADRE Self-Directed Learning Contract," Dec. 5, 1972.

C H A P T E R VIII

REPORT MODES

Since we cannot observe the processes that go on inside of a person's head, we must rely on communication in order to assess learning. We, therefore, need to identify modes of reporting that reflect the modes of examination. We can deduce them by looking at our chart. We can illustrate them by looking at excerpts from students' written reports.

Having explored the processing of information at the neurological, sensory, perceptual, and conceptual levels, we can now assume that learning occurs when a student acquires new knowledge through examining his experience. Again, this involves selecting an area to explore, differentiating between its various parts (becoming more discriminating), identifying patterns, relating the patterns to other symbols in a dynamic way, and synthesizing conclusions.

The growth of competence involves the learning of simpler behaviors and combining them into new, complex wholes which can be activated as a unit. Communication is a competence. The ability to effectively structure a verbal or written report requires the organization of various parts into a coherent whole that accomplishes a purpose. We will explore more deeply the factors which

facilitate self-directed learning in light of these assumptions.

Report Modes That Reflect Examination Modes

The data-gathering examination mode consists of selecting, differentiating, and patterning. We can tell that a student has selected an area when he names it. We can tell that he has clearly differentiated it from others by looking at the way he identifies, describes, and defines it, or compares it with other areas.

To analyze something, a student must look for causes and effects, must relate the data to "hidden" assumptions (about values, roles, themes, principles, etc.), or must look at it through an evaluative frame of reference. When he explains the data, he shows that he comprehends it on a deeper level. When he relates it to other relevant dimensions, he shows how its meaning is clarified or changed. He translates to enhance communication. He evaluates to put things in perspective.

To synthesize a new picture, a person reorganizes, integrates, concludes or predicts. He can report his new picture in a number of ways. He draws conclusions. He reorganizes by planning new directions. He predicts by formulating hypotheses. He integrates by applying theories, testing, demonstrating a whole set of skills, or creating a new work.

These are only some of the possibilities. They serve only as starting lists.

Question type	Intransitive	Transitive	Subjunctive
Examination Mode	Data-gathering	Analysis	Synthesis
	Selection Differentiate Pattern	Connect Modify	Reorganize Integrate Conclude Predict
Report Mode	Identify Describe Define Compare	Explain Relate Translate Evaluate	Draw conclusions Plan Hypothesize Apply Test Demonstrate Create

This chart is useful in that (1) it helps locate the starting point of a learning project; (2) it indicates "where one can go" (if a learner begins with a "why" question, we can direct him "back" to the need for definitions and descriptions, or "forward" to the need to draw conclusions); (3) it gives us a way to assess that learning has taken place.

This third point is of central importance. Without a more discriminating "filter" system, student reports may be seen as pages full of words. As creditors we need to judge not only the content, but the structure and processes behind the content. We need to ask "What is he saying?" and also "What is he doing?"

If indeed the processes that have been identified in this thesis are extensions of innate information-processing operations, then we will see them manifested in students' reports, both verbal and written, even though we may not have specifically asked for them. These different modes may really be codes--patterns and processes that are so efficient at aiding responsiveness that they operate with some autonomy. They may be complicated and confused, since thoughts are formed so rapidly, connections made so quickly, but can a listener who concentrates on content and process acquire skill at discerning them?

Clinical counselors have a background of concepts against which they test the verbalisms (and non-verbalisms) of their clients. As the client talks, the counselor decodes, silently asking such things as "Is he defending himself? Is he projecting? Is he talking like a parent? Is he seducing me? Is he revealing anxiety? Do I sense hidden anger? Does he put responsibility on everyone but himself?" These questions refer to hypothetical processes.

Learning facilitators have no such guidelines, unless they are training rats, or marking tests for a specific course. Self-directed learners must create their own curriculum, relying on their individual abilities to clarify and structure and explore. The facilitator can help him see that he already possesses skill at examining

input, even though he may have lost sight of that fact through years of prescriptive learning. The facilitator must also have a set of measurers which transcend academic disciplines. He must be able to ask "Is he describing clearly? Is he looking at the effects of one thing on another? Can he see the implicit assumptions in his conclusions?

Data-gathering Report Mode

Barbara Weinberg, the student who was interested in education for the blind, began her report by breaking down the gross concept of blindness into finer and clearer sub-areas through defining.

> In section 136, chapter 6 of the General Laws of Massachusetts, blindness is legally defined as, 'whenever upon examination at a clinic, hospital, or other institution or elsewhere by a physician or optometrist, the visual acuity of any person is found to be with correction of 20/200 or less in the better eye or the peripheral field of his vision to have contracted to 10 degrees radius or less, regardless of visual acuity.
>
> This means that a person who has 20/200 in his better eye must be at a distance of 20 feet to see an object that the normally sighted (20/20) would see at 200 feet.
>
> The restriction of the visual field to an angular distance of 10 degrees or less is referred to as tunnel vision. An individual with such a condition may have normal visual acuity for the area on which he can focus, but his field of vision is so restricted that he can only see a limited area at a time. This is in comparison with the normal visual field being 180 degrees.

> When the term 'blind' is associated with a person, the average individual usually assumes this person lives in a world of total darkness. In actuality, this category of blind persons consists of the fewest number of people:
>
> 60% of all legally blind persons have some useful sight;
> 23% have shadow vision (this means that they cannot see an object clearly, only a vague shadow . . .);
> 8% have light perception (this means that if the person were walking through a building, he wouldn't be able to see any objects and he would be in total darkness. However, if he passed a window with sunlight coming in, things wouldn't be as dark);
> 5% are totally blind
> 4% degree of blindness is unknown.
>
> Of these blind people:
>
> 50% are 65 years or older
> 36% are between 20 and 65
> 9 % are 19 or younger
> 5 % age is unknown
>
> There are three most common causes of blindness: glaucoma, diabetes and cataracts, in that order.[1]

Barbara goes on to discuss the causes, as well as the ways in which blind people compensate for their handicap (i.e. training the other senses to perform functions usually handled by vision, being organized and orderly, using canes, dogs and braille, developing the memory, and using sighted help).

Another student adopted a comparing mode of reporting, using appropriate coded (conceptual) organizers:

> In this paper I will compare what is to me an ideal system for teaching gymnastics to younger children to the system under which I am currently employed. I will divide this paper into several sections: Programs, Teachers, Students, Grouping of Students, Teacher-Student Roles, Teacher-Teacher Roles, Parent Roles and Discipline.[2]

Another student begins her paper by identifying an issue in terms of two approaches to a problem:

> Children vary a great deal in the degree to which they possess reading readiness; the major value of a readiness test is in guiding instruction.
>
> It is becoming more and more apparent over the past few years that the best and most successful method of teaching reading is a matter of concern and of debate among today's educators.
>
> The newest approach to reading has been labeled "individualized reading." It places emphasis on (1) individualized rather than group needs, (2) on reading trade books and a variety of materials rather than reading textbooks selected for the children, and finally, (3) on learning skills while reading rather than learning them for reading.
>
> The purpose of this paper is to study the results of individualized and basal reading programs.[3]

A student who wanted to explore the dynamics of an open classroom first described the physical environment, much as a cinematographer would focus on the setting before introducing the plot.

> Suitland Elementary School is a new school devised for the open classroom. This is its first year. The school is very well equipped for year round teaching if classrooms become overcrowded.

> On the outside there is a lot of area for play; it is grassy with a paved area for basketball, hopscotch, etc.. There are fields set up for baseball and kickball. Inside, the school is set up similarly to Wildwood Elementary School in Amherst. Each classroom is a large room with four to six teachers. . . .[4]

She also describes the teaching done by various teachers and herself.

3rd and 4th Grade

> Teacher A (Science) gave the children batteries, wires and bulbs, and let them experiment with what a circuit was. Soon the children had connected the bulbs after many different trials so that they understood what a circuit was. Then they tested the heat given off by using thermometers.
>
> Teacher B (Math) had all the children on the floor in a large group with their math books. As a group they did the beginning exercises from the book. Many of the children fooled around as the teacher pushed on. I feel the material was so simple that they all became bored. Her presentation was boring to me. Her unexpressive voice put me to sleep. She never smiled, praised them, or paid attention to them.

2nd Grade Science Classes on Space.

> Today I introduced the Unhappy Sun and asked the children to find out why he was unhappy. They said because he didn't have any friends. So I asked what kind of friends does the sun have. One boy said planets. Then children came up to the board to draw a planet they knew. They got all but Uranus and Neptune.
>
> . . . After re-reading my account of this week I see that I am not making many deductions and conclusions from my observations. Therefore, I will try to, next time. I was just too excited because I got to teach and I enjoyed it.[5]

This student had been introduced to the knowledge-based continuum before departing for the school. She correctly pointed out the major problem with the "journal-keeping" approach to self-directed learning. While it acquaints the sponsor with a graphic, and sometimes endless, picture of what was observed, it fails to move into more satisfying analytical or synthesizing modes.

Analytical Mode of Reporting

Barbara Weinberg discusses the effects of the public schools on blind children, using three conceptual organizers (intellectual, social, and psychological dimensions):

> . . . these children suffer socially and therefore psychologically because of the public school system. Because of visual problems, the child needs special help and attention from both the public and itinerant teachers. He probably has special books and needs special tutoring. In some cases the child will be taught typing at a young age for easier communication purposes. This begins to draw attention to himself from other children and both they and the child begin to realize that there's a difference between them. Often children tease each other. The visually handicapped child has a difficult time dealing with this because he attributes the teasing to his visual problem. Blind children feel inferior and different. As a result they exhibit the effects of emotional problems--short concentration span, fidgety behavior, and loud speech.[6]

While these connections and assumptions may be open to question, at least they are communicated clearly

and based on real observations. What other kinds of connections do we want to encourage that utilize an analytical approach? An interesting direction might have been to place the plight of the blind person in the context of a higher-order theme, like the dilemma of the Outsider. Connections can be made between minority and disenfranchized groups of all kinds, whether they be visually handicapped, racially, culturally or religiously different, or deviant, eccentric and creative. Another interesting analytical approach is to focus on incongruities which remain unresolved. Another is to encourage the student to relate what is studied to his own experience, value system, motives and feelings.

By communicating about a particular child, rather than about blind children in general, Barbara reveals her increasing responsiveness. She illustrates the causal relationship between blindness and feelings of inferiority. The tone of the writing differs from the earlier, objectivity definitive presentation. Yet as professional educators, we sometimes tend to put more trust in the formal, more technical language of definitions and statistics. The fact that students' language takes on a more personal, informal, affective dimension does not mean that analysis is precluded. It merely signifies that the connections being made are more vital and immediate, possibly even

more meaningful since detached rationality is not as likely to engender committed action.

> The oldest girl I met was in ninth grade and her name was Rosemary. She had felt inferior for a long time. She had one glass eye and the other was legally blind. Telescopic glasses were prescribed for her; however, they were so thick and she got teased so much about them, she refused to wear them. With these glasses, reading enlarged print was possible; however, she used braille, which is so much slower, all because of the teasing. She was conscious of boys and all she knew was that every other girl was going out, so why wasn't she? The only thing she attributed the answer to was her blindness. . . . Her teachers were never of much help. They never gave the itinerant teacher any notice of books or tests, and naturally Rosemary fell far behind. She needed so much, especially a friend. Occasionally she would talk to me about boys she liked but only when we were alone, which was only for five minutes in the morning before the itinerant teacher came.
>
> Maybe the reason she sticks out in my mind is because I remember how hard a time of life that was. You start to become socially aware, and the growing up process begins. At least I could take off my thick glasses and see well enough to get around. I don't know what I would've done if I couldn't see anything. She experienced failure after failure in almost everything that mattered to her (school and boys) and it was attributed to her blindness. What do you tell or do for someone in that position?[7]

Another student analyzed his own progress in teaching an art colloquium, by briefly describing a number of sessions and noting a turning point which modified his outlook:

> At the second meeting I decided to lecture for the first hour on two of the basic techniques of painting. Then the students would work on their own for the second hour. I found that I was nervous throughout and trying to please everyone too much.
>
> . . . The third and fourth meetings were organized in the same manner. The work was poor in quality as well as quantity. There was a breakdown in communications. What was I going to do to hold the class together?
>
> . . . At the fifth meeting the group responded to my apparent quiet reflection by asking what was the matter with me. I was going to say 'nothing' but I realized that they cared enough to take the initiative, so they deserved the truth. I told them how worried I was about the class disintegrating, and that my fiance had broken our engagement, which was upsetting me a lot.
>
> All at once I realized that I had their undivided attention. I was giving them my own thoughts about myself, the course, and them, and how the three areas were not interacting properly. We began to discuss the philosophy of art (my strongest point) and my philosophy of life, and how the two are similar, dissimilar and tightly interwoven.
>
> . . . From that time on, we began to come together as a learning unit.[8]

A third student moved from a descriptive mode to an analytical one by translating a theoretical approach to disturbed children into his own meaningful terminology and showing how the structure of the school worked in a therapeutic way.

This paper has a dual structure. Its first half is 'objective' in the sense that the narrator examines the application of a theory at a distance; he is an onlooker. The obverse of this approach focusses on the narrator as hero, all occurrences being related as he perceived them; no distancing.

Brandon's therapeutic foundation rests on the work of Fritz Redl and Bruno Bettleheim. The treatment theory is called 'Milieu Therapy', a term coined by Bettleheim. Of it Fritz Redl says, 'The term is originally meant to imply the exposure of a child to total environmental design for treatment. . . we expect environmental stimuli to do the treatment job with us and for us.' [F. Redl, Children Who Hate (New York: Free Press, 1951), p. 86.]

I think of it this way. A child has been forced into an extreme reaction pattern by an environment which is threatening in terms of physical deprivation, love deprivation, physical injury by parents, suffocation of ego-autonomy by neurotically overdependent, clinging parents, etc.. Insofar as these patterns have been the child's only chance for survival, they are deeply-rooted. Insofar as the child is not a passive being, he tends to perceive and structure new environments along the patterns of the old, which afforded him survival. This structuring includes assigning roles to new people based on flimsy analogies and then setting up situations that seduce the stranger into the role of 'good parent' or 'bad parent'. . . . Milieu therapy seeks to structure the environment to smash old patterns (decrease their usefulness to the child) while supporting the underdeveloped ego functions.

Brandon's daily program is of dichotomous structure. During the day (9 a.m. to 5 p.m.) the children are in a highly structured environment. . . . An analysis of a

> less obviously structured period, afternoon recreation, demonstrates my point.
>
> After dinner, the kids play soccer with two staff members. Think about the game of soccer. What supportive structures are evident? Geography first--it is played on a delineated field with commonly accepted limits. The authority figure is accepted as neutral (implying non-threatening) as compared to parents. Thirdly, the rules apply to all players with equal force. This foreknowledge is a great relief to a child who often receives 'double-bind' (ambivalent) messages. Lastly, the staff's discretion forces the opposing teams to be matched fairly evenly, eliminating the bitter discouragement of being forced to compete in a foredoomed project. The most obvious control mechanism is the running and kicking, which are useful, constructive (coordination development) outlets for aggression.[9]

We can use excerpts from Arlena McPherson's paper about Belchertown State School (for the Retarded) to illustrate the making of evaluative connections. Many concluding statements contain evaluations. The intent here is to differentiate between evaluations that inform a student about future directions, and the making of connections that reveal a value system at work. The former (synthesizing) type is usually made at the end of the project, while the latter (analytical) type is made "in midstream." Note that Mrs. McPherson's description of the transfer of a patient from one institution to the other has an outwardly descriptive tone. Yet we sense that it is far different from the detached definitive descriptions represented

earlier. She is implicitly connecting her observations with a value system, and we suspect that this affective background helps determine what she chooses to report. Her evaluation is understated, but her message comes across poignantly.

> A meeting was called on March 6, 1973 for the Rehabilitation Team to collect the facts leading up to a fire which was started in the women's Rehabilitation Cottage E C-9. The fire was started by a 33-year-old resident who was angry and upset. In my discussion with her after the meeting, she stated that she did not want to hurt anyone or burn the building down, but she was upset with the rehab. staff and this was her way of getting them upset. She stated that she wanted to get out of the unit.
>
> She also stated that what got her upset was that she was given "baby work" in the night school arithmetic class and when she complained she was told that she was retarded and that was all she was capable of doing (whether she was told this in words or it was conveyed by some other means is not clear).
>
> Setting a fire in an institution is serious because of the number of people who are endangered, and two years before, she had been involved with a similar fire.
>
> In this case she went downstairs and sat in a chair, thinking about what she could do to get even with 'everyone' who thought she was dumb and stupid. She set the fire and poured water on it, told one of the other residents, who told the house attendent and the attendent sounded the alarm. Before, Dorothy had decided on her own punishment and she assumed that she would have the same choice this time. Her reasoning did not prepare her for what actually happened.

Information was collected from several people who worked with her and the report was typed up and sent to the Superintendent and the Doctors in charge. A decision was made to transfer her to the Boston State Hospital for a psychiatric evaluation and treatment.

. . . My impression of the hospital was that it was old and dirty. Some attempts had been made to brighten it up with horrible yellow paint with some "art work" over it. The floors were dirty and the furniture was sparce.

The condition of the residents troubled me most as they were untidy and their hair looked greasy and uncombed. Not one could be called decently dressed. It did not appear that our patient belonged here. Would she get the treatment that we had hoped for?

. . . We left about nine o'clock to return home and I felt very depressed about the whole thing. I felt somewhat like I was leaving a child alone in the woods on a cold night.

As we left Dorothy, she was quiet and unresponsive as she walked to the door with us. We hugged her but she held her body stiff and there were tears near the surface which she held back. She was still trying to prove that she was glad to be away from Belchertown State School and that anything would be better than what she had had there.

This experience left me very unsettled. There were many unanswered questions, such as: why was the "evidence" collected so fast? Why did some of the people involved project their own feelings so strongly that it overshadowed the real facts? Why were the old records used as a criterion for judging a woman who had been "rehabilitated" and placed in the community for months? My biggest question is: what

> hope is there for justice for the millions of people like this little woman, who have been wards of the state for so long, ever to have a better life? Where do I fit in to the picture and what can I really do about the unfairness of it all?[10]

Synthesizing Report Mode

To return to Barbara Weinberg's paper, we see that she makes two kinds of synthesizing conclusions. One tries to answer the hypothetical question of whether the blind should be separated from the public schools. She shows that she has gained a new perspective on the problem of educating the blind, having combined her comparisons with deductions about the structure of schools. The other type of conclusion reports the overall meaning of the experience.

> In a residential school, blind children come out equally as high as normal children academically. However, their world, for 18 years, consists of constantly being surrounded by other blind people. The buildings are set up to compensate for their handicap. Unfortunately the real world isn't like that. When they finally do step out into it, the adjustment is overwhelming.
>
> Unfortunately, the public school system caters to the normal, healthy, hearing, seeing, talking, walking child. It is felt by many organizations for the various handicaps that this should change. I must admit that this idea is great but a little too idealistic. From what I have seen and through talks with various people, the public schools at the present time do not have an adequate well-thought out program for integration. While

> the rest of the class is learning their A B C's, who is going to stop and teach the blind child his braille?
>
> . . . When I addressed these questions and comments to the commissioner of Education for the Blind, he agreed with my observations. . . . It is not enough just to integrate; children and society as a whole have to be re-educated in their attitudes toward the handicapped.[11]

> By being able to get direct experience, I have learned more than I ever expected. I was exposed to different aspects of blindness and saw some of the problems: education, mobility, communication and rehabilitation. In addition, I went to so many places; some of these were Leed's Veterans' Hospital, Florence's Rehabilitation Unit, Goodwill, all of the schools in Springfield, and the Mass. Assn. for the Blind. I met all sorts of blind people in their homes. . . . I learned how to act with them--completely normal.
>
> Something I consider of equal importance is that instead of wondering what I'm doing in school, through this experience I finally have some sort of direction. I have really become interested and fascinated and I know this is something that I will continue to be involved with. I hate to sound so finalized, but I think this is the field I want to go into.[12]

Another paper represents a learning project which moved from one end of the continuum to the other. This student was a biology major interested in testing her competence as a teacher. Her contract reflected a desire to first compare various teaching techniques in a high school, organize a teaching experience for herself based

on her analysis, and to synthesize a curriculum design to be submitted to the head of the Science Department for evaluation.

Excerpts from her final report show that she had examined various approaches through differentiating and giving examples, observed the consequences of her own demonstration, and applied logical principles in producing a curriculum plan.

> . . . I noticed distinct approaches to teaching in the different 'tracks'. . . . A lecture approach was used with the college groups with the assumption that this type of student could learn more with this technique. The general Biology classes differ in that there is far less lecturing and formality. The teacher tries to have greater participation by the students in all activities of the class. Examples of this would be one class learning about plant growth by actually doing library research, potting plants, making cuttings, using different types of soil and commercial fertilizers, etc.. Students from other classes would sometimes bring in 'sick' plants and work with them before school to make them well.
>
> . . . I held a lecture lab demonstration with the sand shark, which I dissected. This was done for 15 different Biology classes. . . . The method used was to work with only eight students at a time around the table. In this way individual attention could be paid to each question the students had. The response was unbelievable! The majority of students asked me where they could obtain sand sharks to dissect on their own.

> . . . In outlining a course in comparative anatomy for next year, I suggested the lab manuals:
>
> Comparative Anatomy by Libbie Hyman
> Comparative Anatomy by Saul Wischnitzer
> I suggested which animals to order and suggested that a more systematic approach to taken to the dissecting (e.g. dissect for circulation the fish, then the amphibian, then the reptile, then the birds and then the mammals) so the students can see the structural evolution of systems rather than dissecting all systems of a fish and then all systems of a reptile, in which the students would not see the connection.[13]

Another student essentially synthesized a creative plan for teaching folklore, creative writing, and an introduction to racial problems. Her report reflects this plan, as well as her conclusions about what she learned as a potential teacher.

> My class in Ethnic American Folklore last semester got me so involved and interested in the study of folklore that I wanted to do something with it. I thought that folklore was an ideal way for children to learn about another culture. So I arranged to teach a class in Black and Indian folklore to fourth, fifth and sixth graders.
>
> . . . The class consisted of two units--the first being on Indian folklore. My main source was The Storytelling Stone edited by Susan Feldmann. I started the unit by discussing with the children some definitions of folklore, and the distinction between myths and tales. . . . I told the class how Indians named their months using a descriptive phrase describing the particular time of the year. Before I gave them the Sioux names for the months, I asked them to

make up their own. They read their name out loud, and the others guessed which month was being described. These are some names that they came up with:

January - The Cold Winds Blow
Beginning of the Year
The Moon of White Land

April - When Clouds Burst
Thunder Roars With Anger
Cloud Sweller Takes Pity

June - The Secret Water Hole
When Feet Go Bare
When People Are Smart

July - Rockets
When Bald Heads Shine
Lightening Flashes

I asked each person to write their own myth, based on what we had learned about myth structure.

. . . In starting Black Folklore, I explained how the different forms evolved--starting with slave stories, to work songs, prison songs, and stories, and blues and jazz. My major source was The Book of Negro Folklore by Hughes and Bontemps. We talked about how the Black self-concept changed and was reflected in this evolution. We began with Brer Rabbit--everyone knew Brer Rabbit stories, but they had never thought about the rabbit. . . . Brer Rabbit to them was 'smart, fast, reckless, skinny, slick, weak in body, outsmarts the fox every time, doesn't panic.' They discussed whether or not the rabbit was a coward. The general consensus, after some thought, was that he acted like a coward, but he wasn't one.

. . . I was surprised at how little they knew about slavery. We discussed a quote from Martin Luther King: 'Lord, we ain't what we oughta be. We ain't what we

> wanna be. We ain't what we gonna be. But thank God, we ain't what we was.' We all discussed what it meant.
>
> . . . I wonder who learned more from those two weeks--the kids, or I? I learned a lot of things that will help me as a teacher. I learned that favorites in a class are easy to have, and that this is something I would have to be constantly aware of when I have a class, so I can overcome it. I learned that I can never make a statement and have it accepted as a truism--children question everything, and I admire it! I learned kind of a crazy thing--that out of twelve written evaluations I received, ten of them said I should have been stricter with them. . .[14]

A final excerpt shows the integration of principle and practice in such a way that the student grew more responsible as a leader. She was involved in counseling and community-building in a college residence hall.

> Am I a capable 'leader' for these people?
>
> By leader I mean a person who can get things moving in such a way that he/she can leave the group with no drastic change in its functioning.
>
> After some changes in my methods I have decided that, yes, I am a capable leader. I first learned that I could not be unorganized or even casually prepared in my presentation at a meeting. I had to be ready to state precisely what I expected. However, I also had to openly say that changes could be made. Nothing can ever be assumed; I should not expect others to assume what I am thinking.
>
> A successful way to determine if a group could function well without me was to turn the meeting over to another member. In some cases this had to be done a few

> times before I could make any separation from a group. Each time I decided to stop heading a committee I told the members why--that I thought they were able to do it themselves. Also I told them that I would always be willing to lend them a hand and answer any questions. I've been kept informed of what's happening in each group and they're all working, except one. That one seems to be dying because of a lack of organization on the part of the present leader. I have talked with her and will see in time what happens.
>
> What changes, if any, have become evident in myself and the other members?
>
> I have become quite a bit more selective with regard to what problems I will listen to. At first I was listening and discussing with everybody. Now, I don't listen to those problems that I know I am not capable of helping, for example, psychological difficulties of girls who have had previous psychiatric care. If I am in any doubt as to my capability I immediately suggest that the girl see the school psychologist.
>
> Now, too, I don't feel uncomfortable telling a student that I am only giving her my opinion. For a while I was hesitant to say that I could be wrong, for fear of (1) losing her confidence and (2) losing my pride. After thinking about it, though, I determined that it is better to face reality than fantasy.[15]

These excerpts represent successful self-directed learning projects. They show the ways in which students can describe, define, analyze, and draw conclusions. They indicate that learning has occurred. By encouraging the learner to use his own style of reporting, yet to be aware of the examination processes that constitute learning,

a facilitator can make the self-directed experience more satisfying. He can help the student more clearly evaluate what he is doing and how he can improve.

Communication is at the heart of facilitation as well as evaluation. Since the student is not studying a field or taking a course in the traditional sense, there is no way to determine how much he "should" learn. However, the facilitator can ask himself what more he wants to know, as a listener whom the student is educating, not as a judge. "Do I want more background? Do I need more descriptive detail to really get the picture? Would I enjoy hearing how this person's values changed as a result of his experiments?" By noting the gaps in his own perceptions of what the student has experienced, and requesting appropriate report modes, the facilitator makes the assessment of learning a mutual exploration.

Footnotes to Chapter VIII

[1]B. Weinberg, "CADRE Self-Directed Learning Contract," Sept. 1972.

[2]S. Arakelow, "CADRE Self-Directed Learning Contract," Feb. 15, 1973.

[3]B. Bistrek, "Final Report," May, 1973, p. 1.

[4]S. Elliot, "Journal," May, 1973, pp. 12-13.

[5]Ibid., p. 13.

[6]B. Weinberg, "Final Report," May, 1973, pp. 10-11.

[7]Ibid., pp. 11-12.

[8]W. Kittredge, "Teaching the Art Colloquium," Nov., 1972, pp. 3-4.

[9]J. P. Clark, "Progress Report," April 25, 1972.

[10]A. McPherson, "Final Report," April, 1973, pp. 6-8.

[11]B. Weinberg, "Final Report," Dec., 1972, p. 13.

[12]Ibid., pp. 20-21.

[13]J. Gorfien, "Independent Study Project in Secondary Biology," Jan. 28, 1973, pp. 14-15.

[14]G. Kaplan, "Final Report," Feb. 23, 1973, pp. 1-4.

[15]C. Veneri, "Final Report," Nov. 5, 1972, pp. 1-2.

C H A P T E R IX

VALUE CONSIDERATIONS

The self-directed learner is "self-directed" by virtue of the fact that he can:

(1) identify goals for himself;

(2) plan activities which work toward those goals;

(3) evaluate his own progress;

(4) take major responsibility for his own growth.

He is a "learner" when he consciously gathers data, analyzes and synthesizes. We have spent considerable time delineating what is meant by "learning" so that we can encourage students to use various modes of examination, and so that we can judge that learning, rather than mere experiencing, has taken place.

In this chapter, we want to return to our basic premises about knowledge and competence in order to see these as part of a broader value system. We want to look at self-directed learning in conjunction with the "whole person." We want to ask what will motivate a learner to take responsibility for his own exploration and growth, after he has been so accustomed to depending on faculty members, grades, and assignments.

Motivation

What have the experts said about motivation? There is a field of behavioral science known as "dynamic psychology." It is concerned with explaining how behavior is aroused, regulated, and sustained. This field, like the learning theory field, has two major opposing camps. Both imply a set of values and assumptions about human nature. Both have been used by counselors to establish a picture of health and normality.

The first group of theories can be called the "drive-reduction" theories. They have been articulated by such scientists as Freud, Adler, Jung, Horney and Skinner. Their approach to behavior can be called "negative" because motivation is seen as basically a negative force--an attempt to reduce the tension produced by needs and drives, to escape from anxiety, to keep the thinking and feeling processes as stable as the biological functions. The principle of homeostasis figures significantly in their thinking. They assumed that organisms are guided by a desire to keep the quantity of excitation as low as possible, or at least constant.

In contrast, the "goal-seeking" group asserted that both rats and men are pleasure-seeking creatures, and that many tension-producing activities are inherently

rewarding. Among this group are such theorists as McDougall, Allport, Lewin, Goldstein and Maslow.

Freud's interest in underlying physiological states and instincts reminds us of the Greeks' interest in biology and the nineteenth century scientists' curiosity about driving forces in animal behavior. Freud postulated a "life instinct" (Eros) which was constantly at war with a destructive "death instinct" (Thanatos). These supposedly arise out of tissue needs, and express themselves as desires to reduce the accompanying tension. The sex-drive, therefore, is something to be disposed of, hopefully through sublimation, although in its constant battle with the nagging superego and the passionate id (which Freud described as "a cauldron of seething excitement"[1]), the ego may resort to more neurotic defenses in order to relieve the tension (e.g. repression, reaction formation, repression, rationalization, projection and fantasy[2]).

While Adler's theories of motivation stressed social rather than biological factors, he continued to view behavior as a response to negative states--feelings of inferiority and helplessness. Human beings possess an inherent urge to escape their insecurity through compensation, through the urge to dominate and be superior, and they have to work especially hard at it

if they are burdened with "inferiority complexes" as is likely to be the case for "children with organic defects, female children, and those born into minority groups."[3]

Jung was fond of differentiating behavior patterns into pairs: individual consciousness vs. collective consciousness, introversion vs. extroversion, thinking vs. feeling. He believed that whatever is happening consciously is opposed unconsciously by its polar tendency. Masculine, extroverted, cognitive behavior hides feminine, introverted, intuitive modes. The aim of learning or therapy, then, is to form a working integration of all these conflicting polarities.

Karen Horney preferred triads. She saw three fundamental "neurotic" trends: (1) moving toward people (making excessive demands for love); (2) moving against people (overcoming insecurity by developing power); (3) moving away from people (withdrawal), While her Neo-Freudian orientation stressed that the culture is a primary definer of "healthy" as well as "deviant" behaviors, she still emphasized anxiety as a basic motivator.[4]

Thordike's "law of effect" has already been discussed. Reward and punishment determine behavior, in his view, and reinforcement is seen as a drive-reducer. Hull tried to refine and liberalize Skinner's S-R theories, but he still considered the primitive drives like hunger,

sex and avoidance of pain to be the only motivational factors in learning.[5] In a way, these psychologists remind us of the earlier philosophical hedonists. Bentham's writings clearly proposed that man seeks pleasure and avoids pain; his theories engendered the British common law mania to make the punishment fit the crime.[6] Our present penal code is based on the assumption that punishment acts as a deterrent. Our present grading system is based on the assumption that low marks will inspire nobler efforts.

Hilgard summarizes the general trend in the first half of this century:

> . . . the Zeitgeist favored our seeing incentives not as providing something sought after for what was inherent in the incentive, but something providing relief. The incentive was seen as an avenue of escape from pain, anxiety, tension.[7]

And Koestler adds, "Just as Freud's libido theory had no room for dalliance, so learning theory had no room for curiosity and learning-by-play."[8]

Turning to the other camp, we find the British psychologist William McDougall asserting that striving toward a goal is more satisfying than reaching it. Like Tolman, he emphasized "purposiveness" and "expectancy", rather than conflict, as characteristics of mental processes.[9]

Allport's principle of "functional autonomy" states that activities which were once motivated by fear or obedience can later become enjoyable and autonomous in their own right. Once functional autonomy is achieved, striving is maintained and equilibrium is resisted, according to Allport.[10]

Allport therefore opposes the principle of homeostasis as a key motivational concept. He believes that when curiosity is aroused and mastery is achieved, all sorts of pleasurable activities are maintained. Recent experiments by C. T. Morgan have demonstrated that rats will press bars in a Skinner box thousands of times per hour to receive shocks to the "pleasure centers" in their brains. We can assume that rats are indeed pleasure-seekers, although they have never expressed an opinion on the subject. Morgan believes that central reinforcing and control units may include an exploratory or curiosity drive which is just as basic as the visceral drives of hunger and thirst.[11] By picturing the drive to explore, manipulate, taste, see, or otherwise receive stimulation from the environment as a "sensory hunger", we can see a synthesis of the two opposing viewpoints--drive-reduction and exploring are interrelated.

We have already noted the mechanisms in the sensory system which enhance contrast, sharpen attention

and arouse interest. The organism's need to see clearly and hear distinctly apparently relates to the adaptive necessity to extract information from the environment, just as it must derive energy from food and sunlight.

> Perception is polluted by implied hypotheses. To look, to listen, to taste means to ask questions, and mostly they are leading questions.[12]

Lewin, Goldstein and Maslow extend the goal-seeking perspective to more abstract levels. Lewin rebelled against the behaviorists' tendency to speak about motivation in terms of "hours of deprivation". He stressed the importance of individual cases in specific situations. He conceptualized a "life-space" for every person, which represents his past, present and goal-directed future. A highly educated person has a "well-differentiated" life space. His needs arise from intentions to achieve goals, not from unliberated sexual energy. Conflicts arise when an individual has to choose between two equally positive or negative directions, or feels a desire to approach as well as avoid a goal.[13]

Lewin's "field theory" gave rise to several fascinating experiments. One series has implications for the learning facilitator. Lewin, Lippitt and White studied the effects of "democratic" vs. "authoritarian"

atmospheres on the productiveness and general behavior of boys. Chaplin summarizes:

> The following techniques were utilized by the adult leaders to create an authoritarian atmosphere. To begin with, the autocratic leader made all decisions. The final objectives of the work projects were not revealed to the children in advance. Rewards and punishments were directed at individual children. Finally, the authoritarian leader remained 'aloof' from the children unless actively engaged in directing a project.
>
> The democratic leader made all decisions a matter for group discussion. Alternative solutions were suggested whenever problems arose. Goals were announced in advance, and whenever it was necessary to administer praise or reproof, this was done objectively.
>
> In general, the democratic groups were more productive, less demanding of the leader's time, more friendly in their approach to the leader and less riven by internal dissention within the group. The democratic group's productiveness remained relatively high even though the leader came in or left during the course of a session. The authoritarian groups tended to be either more aggressive or more apathetic than the democratic groups.[14]

Goldstein's holistic frame of reference leads him to believe that there is only one fundamental motive in human behavior, which he calls "self-actualization".

> Hunger, thirst, the reproductive drive, the desire for knowledge, power, prestige and other primary and 'social' motives are but special manifestations of the basic tendency to realize the self. The fulfillment of needs is not the mere release of tension and elimination of

> deficiencies, but the more positive goal of joy in achievement and the pleasures of exercising one's capacities and abilities.[15]

Maslow rearranged these concepts into a hierarchy, asserting that those needs which have the greatest potency at any time will dominate behavior until they are satisfied. This is a sort of inverted need-reduction theory. Rather than breathing a sigh of homeostatic relief when his physiological needs are taken care of, the individual begins to pursue goals on the next highest level: safety and security. The third level involves belongingness and love needs. The fourth concerns esteem--the need for positive self-regard, competence and independence. Finally, if all these needs are relatively satisfied, the need for self-actualization impels the individual to develop the potential talents that he has.[16]

We will return to Maslow shortly. At this point, let us "departicularize" the two major approaches to motivation."

Drive Reduction	Goal-Seeking
Motivation as escape from negative states	Motivation as striving toward positive states
Emphasis on 'low-level' drives--hunger, safety, sex, etc.	Emphasis on 'high-level' needs--self-esteem, self-actualization
Concentration on 'bit' learning	Concentration on patterns and wholes

Pessimistic-- stresses need for control, overcoming of conflicts	Optimistic-- advocates faith in freedom and natural organismic impulses
Behaviors important	Feelings and thoughts important

How shall we assess these theories? We can see immediately that the drive-reduction approach seems to fit nicely into the therapist's office and the traditional classroom. For all of the professors who abhor the idea of using competition and fear as motivators, they are still limited by a system of schooling which rewards and punishes students according to how well they perform the instructor's tasks. By giving a series of lectures to large, faceless audiences, a professor "fills up" passive receptacles with knowledge, bit by bit. He tries to control "negative" tendencies (e.g. day-dreaming, neglecting studies, attending to personal matters instead of scholastic pursuits) rather than allowing students to motivate themselves, make their own plans, and live with the consequences.

The drive-reduction perspective gives us a rather pessimistic view of human nature. There is no ideal vision of the whole man, only a picture of ego-states battling for control. Yet the drive-reduction theorists have produced many concrete techniques for motivating changes in behavior. They highlighted the importance of

rewards and observable behavior. The behaviorists were the first to introduce the notion of a contract (in counseling theory) as a useful tool for changing behavior.

The goal-seeking approach has an attractive vision of man--as a "self-actualizer" striving to achieve the best in himself. Yet their theorists have proposed very few techniques for motivating people. They assume that the motivation is built in, and the role of the educator or counselor is to help him meet his needs. But we know by experience that merely placing a student in a stimulating environment does not guarantee that he will take responsibility for learning and growing. It may simply leave him groping for reference points. And to assume that it is the obligation of a facilitator to meet the needs of students (i.e. emotional and psychosocial needs) in the belief that this will free their self-actualizing tendencies can lead to increased dependency, not increased autonomy. We want the option to meet some needs and not others. We want to allow students to explore what they need to explore. Yet one danger in adopting a preoccupation with freedom and feeling is that it can lead to a diminished respect for directed analysis, communication, and collaboration. As facilitators, we must work at handing responsibility over to our students.

We must consciously clarify and implement values which encourage the taking of responsibility, and the growth of responsiveness. What are these values?

We can trace some of them indirectly to Maslow. His research into self-actualizers has produced some very valuable ideas. However, the problem with the goal-seeking theorists is that they see growth in knowledge and competence as a natural exponent of need-fulfillment rather than conscious effort. The assumption in this chapter is that "learning how to learn," learning how to chart your own course and achieve your own ideals of excellence, takes effort and dedication. Let us illustrate this.

Maslow studied the personalities of various "self-actualizers," including Einstein, Beethoven, Thoreau, Spinoza, Schweitzer, Lincoln, and Eleanor Roosevelt. He implies that these people achieved greatness because their "lower level" needs were met. Having read the biographies of Mr. Lincoln[17] and Mrs. Roosevelt[18] I came to question whether their needs for security, belongingness, love, sex and self-esteem were very well satisfied at all.

Both of these people experienced the insecurity resulting from the death of their parents when they were young. Both were painfully self-conscious, tending always to minimize their own importance, apparently very

unsure of their self-worth. Mr. Lincoln was characterized by others as perpetually sad and alone, and from the descriptions of his rather strident wife, probably experienced something less than marital bliss. He appeared to be more at ease in the company of men, as Eleanor came to depend heavily on close relationships with a few trusted women. Gore Vidal pointedly remarks that "Eleanor did not like sex, as she confided in later years to her daughter. Franklin obviously did."[19] Eleanor was continually in conflict with Franklin's manipulating and belittling mother, and she suffered repeated disappointments from friends.

Can we explain their enormous contributions by invoking Maslow's pyramid? Let us instead compare the two in another way. Neither Lincoln nor Mrs. Roosevelt went to college, yet both educated themselves thoroughly. Apparently this drive to seek knowledge was an outgrowth of their profound interest in what was going on around them, and what would be useful to them as competent adults. Lincoln went out of his way to borrow various classics and law books, preparing himself as well as he could for a career in law. Eleanor studied as a girl under Marie Souvestre, a philosopher, novelist and educator who was vigorously committed to curiosity, independent thinking and thoughtful self-expression. A pupil remarked that

Mlle. Souvestre succeeded "in exciting, in amusing, in passionately interesting the intellect, in putting such a salt and savor into life that it seemed as if we could never think anything dull again."[20]

They both developed a highly attuned responsiveness to their environments. They were excellent listeners, and as a result, literally thousands came to them for help. The ability to concentrate, empathize and "connect" with people was evident, Lincoln illustrating his understanding with countless funny stories, and acts of kindness, Mrs. Roosevelt acting as the nation's first ombudswoman. Their skill at analyzing situations was matched by their responsibility as decision-makers and their effectiveness as communicators. Both learned to examine problems thoroughly and to synthesize speeches that deeply affected their audiences. Eleanor reported her experiences in a daily column, never missing a deadline. They were both disciplined, self-sufficient and committed to ideals, yet they adapted their operating strategies when feedback required it, and they sought unconventional solutions to problems.

Both of these people embody the qualities we associate with self-directed learners. They studied on their own, they worked, they planned, they acted in light of their goals and values. They grew more effective at responding to their environments. They became more

responsive, and more responsible. They developed the talents they had, in the ways that they could.

Can we clarify a value system which supports or represents this kind of growth? Let us look back at our initial propositions.

> Learning is the increased ability to respond effectively to the environment, through the acquisition of knowledge and competence.
>
> I. Knowledge and Competence
>
> A. Increased ability to respond involves the development of structures which examine the input in more discriminating ways, and organize responses in more efficient ways.
>
> 1. The organism becomes more attuned to the environment by learning to recognize new patterns. This involves testing, matching, and modifying.
>
> 2. Digital-to-analogue conversions are efficient and can be hierarchically organized.

Responsibility and Responsiveness

How can we elaborate upon these ideas in order to generate motivating values? The word "respond" is a good place to start. The Latin word "respondere" means "to pledge back." Breaking it apart, the "re-" connotes a reply, an answering back, an involvement with the outside world. To be responsive is to perceive reality clearly,

to collaborate with others (to respond to them and with them), to become more appreciative and more discriminating, to enjoy the world, to ask questions, to adapt, to create.

The "-spondere" part implies a pledge, a commitment, an ability to be accountable, to be trusted, to be consistent, to be efficient. It entails the ability to distinguish between right and wrong, and hence to think rationally, to be reliable. If we redefine "right" as "authentic," then we connect reliability with integrity--the ability to behave in ways that are congruent with a stable sense of self. It implies responsibility. We connect responsibility with self-acceptance, autonomy, the ability to be detached enough not to be manipulated or compromised. To do this is to exercise control, and to be in touch with problem-solving activities which transcend selfish interests. We use our intelligence to order things, to choose the ways in which we examine and act.

To become more discriminating is to become more responsive. To become more organized and efficient at acting is to become more responsible. The above concomitant qualities are connected with three models of health, Maslow's, Rogers', and Barron's.

Abraham Maslow explored the characteristics of self-actualizing persons. Such individuals display the

following qualities:

(1) more efficient perception of reality and more comfortable relations with it (an ability to detect phoniness and dishonesty, acceptance of the unknown);

(2) acceptance of self and others (lack of extreme anxiety, fear, guilt);

(3) spontaneity (naturalness, unconventionality of thought);

(4) problem centering (rather than "self-centering", having a wide frame of reference, a task to fulfill which is nonpersonal or unselfish);

(5) the quality of detachment (the need for privacy);

(6) autonomy, independence of culture and environment (dependent of the growth of their own potentialities for satisfaction);

(7) continued freshness of appreciation;

(8) the mystic experience, the "oceanic feeling" (strong emotional response of wonder, ecstasy, limitless horizons);

(9) gemeinshaftsgefühl or feeling for mankind, identification with and sympathy for the human race, desire to help);

(10) deeper and more profound interpersonal relations;

(11) the democratic character structure (capacity to be friendly with a wide variety of people, to learn from anyone who has something to teach);

(12) discrimination between means and ends (between right and wrong, between enjoyment of the "going" and the satisfaction of the "getting there");

(13) philosophical, unhostile sense of humor;

(14) creativity;

(15) resistance to enculturation (inner detachment or tendency toward non-conformity).[21]

Donald McKinnon and Frank Barron studied the personal and intellectual traits of outstanding architects, research scientists, writers, engineers and mathematicians, using a wide variety of tests and rating scales.[22] They found that creativity is positively correlated with unconventionality of thought and behavior, a positive attitude toward cognitive activities, and high intellectual capacity; it is negatively correlated with dependability, sympathy, and conventional morality. A number of other studies reviewed by Barron led to a composite picture of traits found in productive scientists:

(1) high ego strength and emotional stability;

(2) a strong need for independence and autonomy; self-sufficiency; self-direction;

(3) a high degree of control of impulse;

(4) superior general intelligence;

(5) a liking for abstract thinking and drive toward comprehensiveness and elegance of expression;

(6) high personal dominance and forcefulness of opinion, but a dislike of personally toned controversy;

(7) rejection of conformity pressures in thinking (although not necessarily in social behavior);

(8) a somewhat distant or detached attitude in interpersonal relations, though not without sensitivity or insight; a preference for dealing with things or abstractions rather than with people;

(9) a special interest in a kind of "wagering" which involves pitting oneself against the unknown, so long as one's efforts can be the deciding factor;

(10) a liking for order, method, exactness, together with an excited interest in the challenge presented by contradictions, exceptions and apparent disorder.[23]

Carl Rogers stresses the concept of "actualization" in a manner similar to Maslow's approach. In his view, growth involves a tendency toward autonomy, self-acceptance, acceptance of others, and a realistic sense of self-worth.[24] Under conditions of social and self-regard, the

"fully-functioning person" will be open to experience. This means that stimuli from the environment can be freely transmitted through the nervous system, without being distorted by defense mechanisms. In his transactions with the environment, the individual can symbolize accurately and test hypotheses about reality through action and experimentation.[25] He displays an absence of rigidity and an adaptable ability to discover structure within experience. The healthy individual can refer to his own self-structure for evaluation, rather than basing his opinion of himself on the judgments of others.

The qualities listed by these theorists are values which can be related to responsiveness and responsibility. We can rearrange them under the two headings, assuming that traits connected with external, environment-oriented acts relate to responsiveness, and that traits connected to internal, stable structures and personal integrity relate to responsibility.

Responsiveness	Responsibility
MASLOW	
1. Efficient perception of reality	2. Acceptance of self
2. Acceptance of others	4. Problem-centering
3. Spontaneity	5. Detachment
7. Freshness of appreciation	6. Autonomy
9. Feeling for mankind	12. Discrimination between means and ends
10. Deep interpersonal relations	15. Nonconformity

Responsiveness	Responsibility
13. Unhostile sense of humor	
11. Democratic approach	
14. Creativity	

BARRON

5. Abstract thinking ability; elegance of expression (examination and reporting)	1. Ego strength; emotional stability
9. Interest in tackling the unknown	2. Self-direction
10. Interest in contradictions	3. Control of impulse
	4. Intelligence
	5. Forcefulness of opinion
	7. Nonconformity
	8. Detachment
	10. Liking for order

ROGERS

3. Acceptance of others	1. Autonomy
5. Openness to experience (lack of defensiveness)	2. Self-acceptance
6. Accuracy of symbolization	4. Self-worth
7. Hypothesis testing	9. Evaluation based on self-structure
8. Adaptability	

We can now group these qualities and show that guidelines for self-directed learning facilitators can be logically derived from each.

RESPONSIVENESS

I. Efficient Perception of Reality

A. Elicit reports from the student about his own "life space"

B. Check for clarity; request concrete examples, descriptive details, definitions

C. Check for hidden assumptions and biases

II. Abstract Thinking Ability (Accuracy of Symbolization)

A. Encourage analysis of relationships

B. Request translations

C. Clarify criteria and encourage evaluation

III. Hypothesis Testing

A. Encourage application or principles or theories to concrete tasks

IV. Interest in the Unknown (Interest in Contradictions)

A. Encourage questioning

B. Facilitate formulation of issues, examination of both sides

C. Look for incongruities

V. Elegance of Expression

A. Encourage an end product which is "communicable"

B. Respect quality productions by giving feedback about strengths

C. State own criteria for an acceptable piece of writing

VI. Acceptance of Others (Democratic Approach, Openness, Undefensiveness)

A. Point out judgmental behavior

B. Inquire about student's feelings toward other people in the learning environment

C. Encourage humanistic approach

D. Encourage asking for feedback

E. Self-disclose, when appropriate

VII. Adaptability and Spontaneity

A. Encourage the trying of various approaches

B. Allow flexibility in contract renegotiation based on localized feedback

C. Enjoy spontaneous actions and statements

VIII. Creativity

A. Encourage creative response

B. Generate new possibilities

C. Appreciate novelty

RESPONSIBILITY

I. Problem-Centering (Discrimination Between Means and Ends

A. Work toward clear statement of goals and plans

B. Examine problems, questions, interests as thoroughly as possible

C. Clarify longer-range purposes

II. Autonomy (Self-Direction, Ego Strength)

A. Return responsibility to student for decision-making

B. Resist dependency-producing situations

III. Self-Evaluation and Detachment

A. Encourage student to evaluate himself

B. Clarify role of personal needs and fears when assessing performance

C. Encourage reasonable self-criticism

IV. Liking for Order (Control of Impulse)

A. Hold student accountable for meeting deadlines, or responsibly renegotiating them

B. Support self-discipline, planning, intentionality when necessary for achieving goals

V. Nonconformity (Forcefulness of Opinion)

A. Appreciate firm statements about values and perceptions, especially when based on an examination process (rather than fantasy, whim or defensiveness)

B. Encourage constructive questioning of assumptions perpetuated by cultural or social groups, especially when these are not in congruence with student's experience

VI. Acceptance of Self (Self Worth)

A. Honor the individuality of every student

B. Recognize unique styles and qualities by giving useful feedback

C. Convey an interest in what the student has to say

Excellence

To "excel" means literally "to raise oneself." It implies the achievement of higher levels of knowledge and competence. We have asserted that learning involves seeing new patterns, new interrelationships. It means to combine simpler acts and singular ideas into "higher" complexities. We have seen that degrees of freedom increase with each step upward in the hierarchies of skill and understanding, and so does "efficiency."

When we think of efficiency, we picture efficiency experts, mass production, thousands of people doing piecework. This image represents a corruption of the term. Let us look at it in another light. The dictionary defines

efficienty as "ability to produce the desired effect with a minimum of effort, expense, or waste." To be efficient, in a human sense, is to learn to use one's talents well, not to waste them.

It is possible to see universities as tremendous wasters of talent. The very word "university" connotes "oneness," and yet our institutions break up the curriculum into disconnected fragments. They keep the students from building their competence by restricting their activities and confining them to the classroom. They produce either highly specialized technicians and graduate scholars who master tiny topics, or liberal arts degree-holders that can't "do" anything.

It is no wonder that students take up transcendental meditation or mind-altering drugs in order to connect themselves with their environment and their own strengths in a non-"technical" way. It is no wonder that they make time to read Castaneda or Hermann Hesse, whose Nobel Prize-winning novel, Magister Ludi (The Glass Bead Game)created a sort of intellectual Odysseus in a rarefied fantasy kingdom. The Masters that train Joseph Knecht aim at showing him the interrelationships between all fields of knowledge:

> . . . our object is to discern opposites correctly, in considering them primarily as opposites but eventually as poles of

> a single unit. . . . Mark well: one can be a strict logician or grammarian and yet be full of fantasy and music. One can be a musician or a bead-player, and yet be devoted to law and order. The man whom we take as our ideal should be able at all times to exchange his art or science for any other, should allow the most crystal clear logic to radiate from his Bead Game and display the most creative fantasy . . .[26]

Furthermore, the large numbers, the competition, and the impersonality within the modern multiversity serve to increase boredom, anxiety, and separation from one's driving interests.

When student and facilitator can work well as a team, the excitement resulting from mutual exploration makes the fear of failure obsolete, except perhaps in the student's own mind. The facilitation process stresses communication more than competition, growth more than grading. It moves to make education more honest and more exhilarating.

> The effect of the present academic system is to teach the student to conceal his real self, or to leave it undiscovered, and . . . to invent a second-hand version which can either serve as a permanent alibi or as a permanent instrument of social success. . . . To admit ignorance of an answer to the questions raised in the classroom, to question the question, to be spontaneous in the exposure of ignorance, to ask one's own honest questions, not to know what is customary to do, not to be able to perform the conventional academic tasks--these are personal defects to be covered over if possible, and to be overcome by learning the skills of evasion

> and social patter, and the skills of answering the educator's questions. In this way it is possible for young people to conceal the real self even from themselves.
>
> The skills of evasion, or, to put it the other way, the lack of a commitment to seek out the center of learning in oneself, are the easiest to learn and, under the present educational methods, the easiest to teach.[27]

Alienation is a difficult thing to overcome. Our society is plagued by the inability of individuals to feel personally involved. We place more emphasis on credentials and techniques, losing touch with the self-transcending drive toward passionate involvement, which the Greeks called "Eros."

> . . . eros is the power which <u>attracts</u> us. The essence of eros is that it draws us ahead . . . . . Something in me responds to the other person, or the job, and pulls me toward him or it. I participate in forms, possibilities, higher levels of meaning, on neurophysiological dimensions but also on aesthetic and ethical dimensions as well. As the Greeks believed, knowledge and even ethical goodness exercise a pull. Eros is the drive toward union with what we belong to--union with our own possibilities, union with significant other persons in our world in relation to whom we discover our own self-fulfillment. Eros is the yearning in man which leads him to dedicate himself to seeking <u>arête</u>, the noble and good life.[28]

The word <u>aretê</u> is a concept that has special interest. May's translation of it is not quite correct; he even puts the accent on the wrong syllable. Plato's

translation is equally wrong. He defined it as "virtue" which has a moral connotation. For the Greeks, the ideal of aretê did not stem from duty toward others, but from duty toward oneself. H. D. F. Kitto translates it as "excellence."

> It may be limited of course by its context; the aretê of a race-horse is speed, of a cart-horse, strength. If it is used, in a general context, of a man it will connote excellence in the ways in which a man can be excellent--morally, intellectually, physically, practically. Thus the hero of the Odyssey is a great fighter, a wily schemer, a ready speaker, a man of stout heart and broad wisdom who knows that he must endure without too much complaining what the gods send; and he can both build and sail a boat, drive a furrow as straight as anyone, beat a young braggart at throwing the discus, challenge the Phaecian youth at boxing, wrestling or running; flay, skin, cut up and cook an ox, and be moved to tears by a song. He is in fact an excellent all-rounder; he has surpassing aretê.[29]

This heroic ideal pervaded Greek life. Even the Olympian games were designed to test the aretê of the whole man, not only a specialized skill. In fact, the ideal of personal excellence "implies a respect for the wholeness or the oneness of life, and a consequent dislike of specialization. It implies a contempt for efficiency--or rather a much higher idea of efficiency; an efficiency which exists not in one department of life, but in life itself."[30]

By allowing students to pursue their own interests, we encourage them to fight the alienation and fragmentation. By stressing responsibility and striving for communication, we try to restore the vital connection between studies, values, people, and the growth of the whole person.

Self-directed learning, at its best, enables a learner to transcend the boundaries of the academic disciplines, to escape from the boredom of listening to other experts and the anxiety of being graded, and to experience the satisfaction of building his own knowledge and competence. By facilitating this process, the counselor helps the student move toward "excellence" in the Greek sense of the word.

> Ancient Sparta needed warriors, Athens needed a sense of the hero, the ancient Hebrews needed knowledge of the Testament, nineteenth-century Americans needed managers and technicians--and the schools responded beautifully in each case by providing the kind of people the society needed. What do we need now? I believe that we need to restore faith, honesty, humanity.[31]

Footnotes to Chapter IX

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[5]Koestler, The Act of Creation, p. 497.

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[29]H. D. F. Kitto, The Greeks (Baltimore, Maryland: Penguin, 1951), p. 172.

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[31]J. Kagan, "A Conversation with Jerome Kagan," Saturday Review, Vol. I, No. 3 (April, 1973), p. 43.

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